GREEN BUILDING COUNCIL SOUTH AFRICA

TECHNICAL MANUAL

EXISTING BUILDING PERFORMANCE TOOL V1

DECEMBER 2014

TOOL DEVELOPMENT SPONSORED BY:

MAKE THINGS HAPPEN

NEDBANK CORPORATE

Table of Contents

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Acknowledgements

GREEN STAR SA – EXISTING BUILDING PERFORMANCE

The Green Star SA – Existing Building Performance V1 rating tool has been adapted from the Australian Green Star – Performance Tool, under license from the Green Building Council of Australia. The tool has established individual environmental measurement criteria with particular reference to the South African marketplace and environmental context.

The Green Building Council of South Africa (GBCSA) would like to acknowledge all the parties who have worked on and supported the development of the Green Star SA – Existing Building Performance rating tool.

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ADDITIONAL EXPERTISE

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Green Star SA Technical Advisory Group Members

Whilst not mentioned individually, the GBCSA would like to thank all Technical Advisory Group members who continuously contribute to the technical refinement of Green Star SA rating tools.

Green Star SA – Existing Building Performance PILOT Projects

The GBCSA would also like to thank all Pilot projects who applied and tested the rating tool through the course of 2014. Without their valuable feedback and contributions, the launch of this tool would not have been possible.

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Technical content and support provided by:

green building council australia

Green Star Certification

The property industry is well-placed to deliver significant long-term environmental improvements using a broad range of measures. More importantly, it is unique in that it can directly influence and create behavioural changes at all stages of the supply chain. However, there are inherent barriers within the industry that often act to ensure that efficiency measures are not adopted, despite the fact that a strong business case can be made for their implementation. Most significantly, these barriers relate to the owner/manager/tenant divisions or split incentives that often result in the benefits of efficiency or improved performance measures not accruing to the party that initiated them.

The Green Building Council of South Africa (GBCSA) was created in order to address some of these barriers. The GBCSA's objective is to promote sustainable development and the transition of the property industry towards sustainability by promoting green building programs, technologies and practices. A key priority for the GBCSA has been the development of a comprehensive environmental rating system for buildings, known as Green Star SA.

Green Star SA separately evaluates the environmental initiatives of projects and/or buildings based on a number of criteria, including energy and water efficiency, indoor environment quality and resource conservation.

Green Star SA was created to:

- Establish a common language and standard of measurement for green buildings;
- Promote integrated, whole-building design and operation;
- Identify building lifecycle impacts;
- Raise awareness of green building benefits;
- Recognise environmental leadership; and
- Transform the built environment to reduce the environmental impact.

Green Star SA has rating tools for different phases of the building lifecycle (design, construction, operations, refurbishment or fit-out and for different building classes, e.g. office, retail, public & education, multi-unit residential, etc.).

Green Star SA has built on existing systems and tools in overseas markets, most notably the Green Star system developed by the Green Building Council of Australia (GBCA), by adapting and establishing individual environmental measurement criteria relevant to the South African marketplace and environmental context.

Green Star SA rating tools use the best regulatory standards to encourage the property industry to improve the environmental impact of buildings. The rating tools embrace local standards and guidelines, where applicable, to benchmark this improvement.

The GBCSA has developed Green Star SA to provide industry with an objective measurement for green buildings. In assessing those elements that should be rated and to drive change in the market, the GBCSA has been diligent in focusing on areas of environmental impact that are a direct consequence of a building's briefing, design, construction and ongoing operation – that is, those outcomes that can be directly influenced by stakeholders within the property industry.

Green Star Certification

Green Star SA establishes a number of categories under which specific key criteria are grouped and assessed. This framework is used by each and every Green Star SA rating tool. The basic Green Star SA structure is shown below.

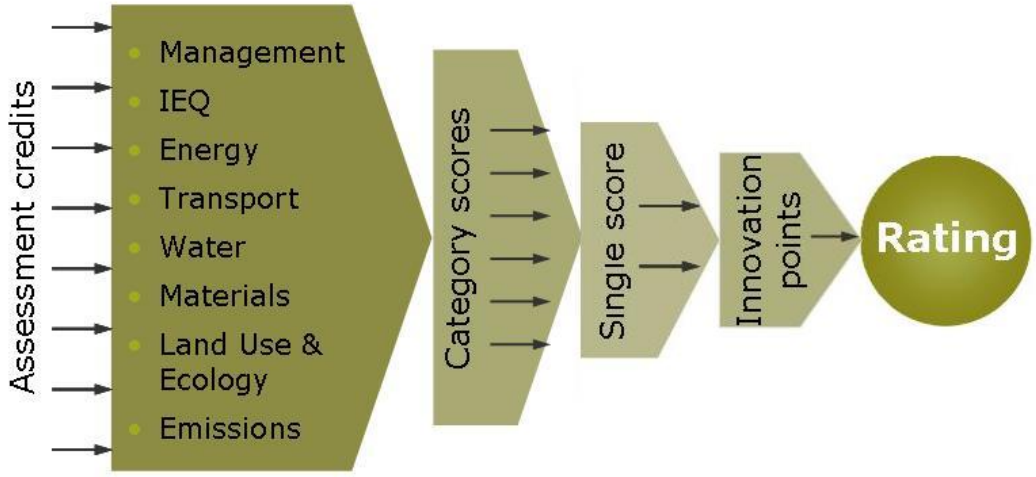

***Figure 1**: Structure of the Green Star SA rating system*

Green Star SA rating tools include nine separate environmental impact categories:

- Management;
- Indoor Environment Quality;
- Energy;
- Transport;
- Water;
- Materials;
- Land Use and Ecology;
- Emissions; and
- Innovation.

The categories are divided into credits, each of which addresses an initiative that improves or has the potential to improve a project or building's environmental performance. Points are awarded in each credit for actions that demonstrate that the project has met the overall objectives of Green Star SA and the specific aims of the Green Star SA rating tool.

To encourage the development and spread of innovative technologies, designs and processes that could improve a buildings' environmental performance, an 'Innovation' category is included in each Green Star SA rating tool.

Category Score

The Category Score is determined for each category based on the percentage of credits achieved, as follows:

$$\text{Category Score} = \frac{\text{Number of points achieved}}{\text{Number of points available}}$$

For example, if 10 Energy points are achieved out of a total available of 27 then the Category Score is 37%.

Single Score

The single (i.e. overall) score is determined by adding together all the Category Scores plus the Innovation points. The maximum possible score for the categories is 100, with an additional ten points available for Innovation, making the maximum attainable score in Green Star SA – Existing Building Performance 110 (out of 100).

The Green Star SA rating is determined by comparing the overall score with the rating scale shown below.

Table 1: Green Star SA – Existing Building Performance Rating Bands

Overall Score	Rating	Represents
10-19	One Star	"On the Journey to a Better, Greener Building"
20-29	Two Star	"On the Journey to a Better, Greener Building"
30-44	Three Star	"Good Practice"
45-59	Four Star	"Best Practice"
60-74	Five Star	"South Africa Excellence"
75+	Six Star	"World Leadership"

As indicated above, the minimum Green Star SA rating is One Star and the maximum is Six Stars. Whilst in Design or As Built ratings, Green Star SA only recognises and rewards market leaders (only certifies 4 Star or above), in the Existing Building Performance tool, the GBCSA recognises that the move to becoming a 4-6 star rated building may be a lengthy journey for some, and those who are doing significant work in reaching this point should be acknowledged along this journey.

Green Star Certification

GREEN STAR SA ACCREDITED PROFESSIONALS

To encourage the adoption of environmental initiatives from the earliest project stages throughout design, construction and operation of a building, all Green Star SA rating tools award points in the Management category to projects that have a Green Star SA Accredited Professional as a member of their team. Furthermore for Existing Building Performance, it is a mandatory requirement that submissions are put forward by a Green Star SA Accredited Professional.

In the case of Green Star SA – Existing Building Performance, a separate Existing Building Performance AP accreditation is put in place, distinct from that of the New Building tools, the involvement of such an individual for the Existing Building Performance certification is mandatory.

Green Star SA Accredited Professionals are experienced building industry representatives who have demonstrated their understanding of the Green Star SA rating system and the benefits of high environmental performance. To become a Green Star SA Accredited Professional, candidates must attend a GBCSA Green Star SA Existing Building Performance (EBP) Accredited Professional course and pass the associated exam. Refer to the Education section of the GBCSA website (http://www.gbcsa.org.za) for further details. The GBCSA is also hosts an on-line directory of Green Star SA EBP Accredited Professionals on their website to enable easy identification and provide the contact details of these qualified service providers.

ASSESSMENT CREDITS

The Green Star SA – Existing Building Performance rating tool is divided into nine environmental categories, each of which has a number of credits.

For each credit the following topics are described in this Technical Manual:

- Aim of Credit;
- Credit Criteria;
- Documentation Requirements;
- Additional Guidance/Background; and
- References & Further Information

Points are awarded within credits for achieving performance-based objectives and for adopting policies and procedures to improve a project's environmental impact.

In some instances credits (or points within credits) may be 'not applicable' to the project's context. This situation usually depends on the nature of the building and the inclusion or otherwise of a variety of typical building features. These specific instances are clearly defined in the Technical Manual. Whenever a credit is deemed 'Not Applicable', points are not awarded, and instead are excluded from the Points Available, used to calculate the Category Score. This modification prevents distortion of the Category Score (up or down) for issues that cannot be addressed and are not applicable to the project.

Green Star Certification

ELIGIBILITY

To be eligible for Green Star SA Existing Building Performance Rating assessment, buildings must meet each of the following four Eligibility Criteria.

1. **Building Characteristics**
2. **Building Use**
3. **Conditional Requirements**
4. **Timing of Certification**

CONFIRMING ELIGIBILITY

It is the responsibility of each project to check the most current Eligibility Criteria at the time of registration and to ensure that their project is eligible.

Whenever unsure, project teams can request an eligibility ruling from the GBCSA by forwarding a brief description of the project to ebp@gbcsa.zendesk.com.

Registration does not guarantee assessment; no project will be assessed if it is deemed ineligible against the Eligibility Criteria current at the time of registration.

The GBCSA reserves the right to deny eligibility to assessment of any project that is deemed to compromise the Green Star SA brand, and to revise these criteria to better achieve the goals of the Green Star SA rating tools.

ELIGIBILITY CRITERION 1: BUILDING CHARACTERISTICS

Below are the minimum building characteristics.

- **Occupied at min 70% occupancy throughout the performance period (vacancy rate below 30%)**
  Examples:
  - For a commercial office building or retail centre, this would mean that on average 70% of the Gross Lettable Area is to be let out over the 12 month performance period.
  - For transient occupancy buildings such as convention centres, on average 70% of the building must be operational (available for use) through the performance period.
- **Be an existing building in its entirety** (tenancies within buildings are not certified)

ELIGIBILITY CRITERION 2: BUILDING USE

The rating tool has been developed to apply to as broad a range of building types as possible. The following building types can register for certification without the need for an Eligibility Ruling from the GBCSA.

Table 2: Building Types eligible to register without GBCSA Eligibility Ruling

Building Type*	Classification of Occupation (SANS 10400-A)
Office Buildings	G1- Offices
Retail Developments	F1- Large Shop
Public Assembly	A1- Entertainment
	A4- Worship
	C1- Exhibition Hall
	C2- Libraries
	C2- Museum
Educational	A3- Places of Instruction

* Note that combinations of eligible building types (Mixed-Use Buildings) will be considered as eligible.

In addition, the following building types may be eligible to register for certification, but require an Eligibility Ruling Request to be sent to the GBCSA before being able to do so. Please contact the GBCSA in this regard.

Table 3: Building Types Requiring an Eligibility Ruling from GBCSA

Building Type*	Classification of Occupation (SANS 10400-A)
Multi-Unit Residential	*H3-Housing*
Industrial Warehouse	*J2- Moderate Risk Storage*
Light Industrial Manufacture	*D3- Low-risk Industrial*
Laboratories	*Laboratories*
Health Care	*E2- Hospital*
Indoor Sports Facilities	*A2- Theatrical & Indoor Sport*

Green Star Certification

* Note that combinations of eligible building types (Mixed-Use Buildings) will be considered as eligible, but require a GBCSA Eligibility Ruling

ELIGIBILITY CRITERION 3: CONDITIONAL REQUIREMENTS

In order to achieve a Green Star SA – Existing Building Performance Rating, the project's submission must be submitted by a Green Star SA - Accredited Professional (Existing Building Performance). As such, the Man-1 credit within the rating tool must be targeted and achieved in order to achieve certification.

ELIGIBILITY CRITERION 4: TIMING OF CERTIFICATION

The following requirements apply in terms of timing of certification.

- **Must be operational for min 12 months after final completion**
- **The building's 'performance period' (period under which the building's performance is measured) is to be 12 consecutive months.**
- **Energy & Water performance periods must end within 90 days of each other**
- **The project must submit for certification within 90 days of the end of the building's 12 month performance period.**
- **Certification is valid for 3 years from the end of the certified performance period. Thereafter re-certification will need to be undertaken.**
- **Re-certification can take place at any time within the 3 year period, but the project's rating will lapse if not re-certified within 3 years.**
- **Annual submission during the 3 year period will be required for:**
    - Energy consumption data
    - Water consumption data

MULTI-BUILDING PROJECTS

It is recognised that developments are commonly split over several buildings all managed as one property. Such developments have the following options for Green Star SA assessment:

1. Single building certification, where selected campus buildings individually undergo assessment and receive individual ratings; OR

2. Single certification for multiple buildings, where all the buildings are certified at the same time and awarded one rating.

To be eligible for a multiple-building certification, the project must comply with criteria set out in the GBCSA's 'Multiple Building Guidelines' document available on request from the GBCSA (ebp@gbcsa.zendesk.com) and in the General Section of the Certification Engine (www.certificationengine.org).

Projects will be required to submit an Eligibility Ruling application to ebp@gbcsa.zendesk.com demonstrating compliance with the 'Multiple Building Guidelines' prior to registration.

Green Star Certification

PRE- CERTIFICATION OF DOCUMENTS

Although the certification applies to individual buildings/projects, the GBCSA has created the opportunity for the certification process to take into account instances where groups of buildings belonging to the same owner (portfolios) apply the same documents (specifications / standards / policies). The intent of this is to ensure that the certification process is practically applicable and does not create any unnecessary administrative burden and costs to such projects. The GBCSA calls this ***pre-certification*** of standard documents.

A guideline detailing the procedure for having portfolio documents 'pre-certified' is available from the GBCSA on request (ebp@gbcsa.zendesk.com), or in the General Section of the Certification Engine (www.certificationengine.org).

RE- CERTIFICATION

The Green Star SA – Existing Building Performance Tool as the name suggests is a rating tool which assesses the actual operational performance of a building. Due to the fact that performance can change over time, each certification is valid for a 3 year period, after which re-certification is required.

As many of the documents may not have changed since initial certification (policies, plans, building attributes), significantly reduced scope in documenting a rating can be expected for re-certification. In essence, re-certification is primarily concerned with 'Measurements & Audits', especially if not many new initiatives are targeted.

Project teams choose at which point in the 3 year validity of their rating they would like to re-certify. There-after the following process is followed:

Step-1 – Register for Re-Certification on the Certification Engine

Step-2 – Review the 'Re-Certification Documentation Guidance'
This document is available from the GBCSA on request (ebp@gbcsa.zendesk.com), or in the General Section of the Certification Engine (www.certificationengine.org). You will note that many documents required for your initial certification are not required for re-certification. Instead, confirmation is simply required within the submission template that no material changes have taken place to the said document (e.g. policy, plan, building attribute).

Step-3 – Use the 'Re-Certification Submission Templates'
Special submission templates are available for re-certification. These are available on the Certification Engine once registered.

Step-4 – Submit using the Certification Engine
Submissions are done using the Certification Engine where your submission templates and accompanying documents are uploaded. Note that as with initial certification, 2 Rounds of Assessment are available to you.

CERTIFICATION PROCESS

Up to date information on the Green Star SA certification process is outlined in detail on the GBCSA website (www.gbcsa.org.za) and Certification Engine (www.certificationengine.org).

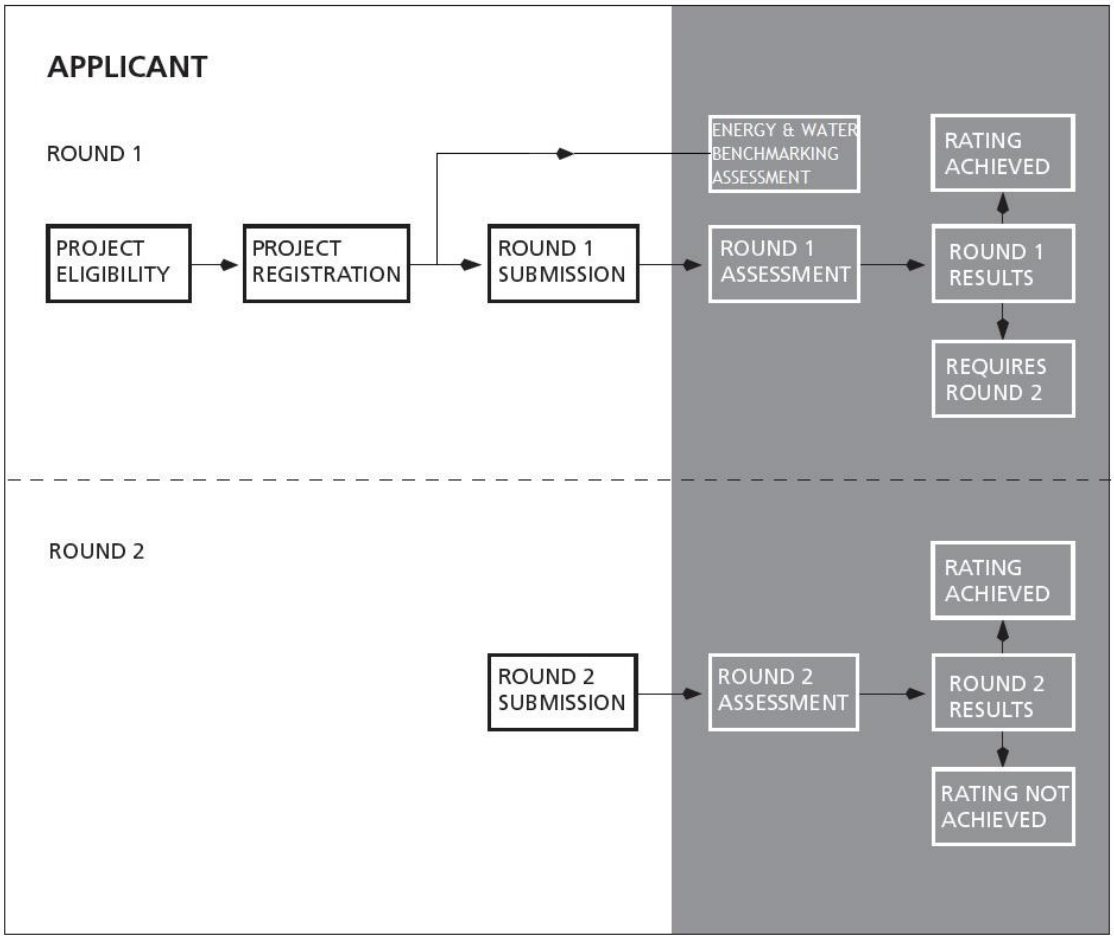

Figure 2: *Overview of certification process.*

Preparing the Submission(s)

Once your project is registered, the project team should prepare documentation to satisfy the Green Star SA credit documentation requirements and submission templates. The Green Star SA Accredited Professional (whether externally appointed or part of the internal building management team) should take responsibility for the quality of submission.

It is important to ensure that documentation for all claimed credits adheres to the 'Documentation Requirements' outlined in the Green Star SA – Existing Building Performance

Green Star Certification

Technical Manual as well as the Submission Template provided for each credit within the Certification Engine (www.certificationengine.org).

Assessors will not award the point(s) unless it is demonstrated that all the requirements have been met exactly as detailed in the Technical Manual and requested in the Submission Templates.

ENERGY & WATER BENCHMARKING

For Office buildings, projects will have the option of submitting the Energy Consumption and Water Consumption credits (Ene-1 and Wat-1) for assessment prior to submission of all other credits for assessment. The Energy & Water performance will be assessed and a formal Energy & Water Benchmarking Certificate issued to the project by the GBCSA.

The following information is required to be submitted for Energy & Water Benchmarking:

- Completed Submission Templates for Ene-1 and Wat-1 credits with all supporting documents as called for in the templates.

From submission of the Energy & Water benchmarking info to the GBCSA, results will be provided within 5 weeks of submission.

SUBMISSION (Round 1)

From the date of receipt of the project's submission of all targeted credits (Round 1), the GBCSA provide the assessment results within 7 weeks.

Projects must submit all required documents via the Certification Engine (www.certificationengine.org).

The GBCSA will conduct a pre-assessment submission quality review of a project submission prior to the commissioning of a review by the Assessors. A project may be required to resubmit the submission prior to assessment if the submission quality review suggests that the quality of the submission would result in an erroneous or extended assessment. There is no fee associated with the pre-assessment completed by the GBCSA.

ASSESSMENT (Round 1)

The Assessor(s), will review the submission. Recommendations will then be made to the GBCSA on the rating which should be awarded.

The GBCSA will forward the results of the Assessment to the project contact and the applicant. At this point a rating could be achieved and the certification process completed.

However, the Assessors may request additional information from the applicant supporting their claims, or may request corrections to certain credits not achieved. In such a case, the project team must submit the required documentation for credits 'to be confirmed' in a Round 2 submission.

SUBMISSION (Round 2)

Upon receipt of the results of the Round 1 Assessment, the project may be required to submit documentation for credits 'to be confirmed'. The project will be required to provide the Round 2

submission within 90 days of Round 1 Assessment results being issued. Each project has only one opportunity for resubmission (Round 2), which may include:

- Additional/revised documentation to demonstrate fulfilment of Credit Criteria;
- New credits not targeted in Round 1. Note however that there will not be the opportunity for two rounds of assessment on these credits.

From the date of receipt of the Round 2 submission at the GBCSA offices, the GBCSA provide the Round 2 assessment results in 5 weeks.

ASSESSMENT (Round 2)

Assessment of the Round 2 submission will follow the procedures outlined above for Round 1 assessment.

CERTIFIED RATING AWARDED

If the assessment validated the project's achievement of the required score, the GBCSA will award a Certified Rating and notify the Applicant.

CERTIFIED RATING NOT AWARDED

If a desired Certified Rating is not achieved, the project may in certain circumstances be eligible to Appeal select credits for a fee to re-asses. Please contact the GBCSA for further details in this regard.

GENERAL SUBMISSION REQUIREMENTS

The submission requirements for each credit are set out within the 'Documentation Requirements' section of the credit, as well as listed in the Certification Engine and Submission Template.

Aside from credit submission requirements, it is essential that the following general documents are uploaded to the 'General' section of the Certification Engine.

- **Site drawing showing extent of the building and project site**.
  Where no drawings are available, an aerial photograph (such as those obtained from Google Maps or similar) is acceptable provided the building and site extent are clearly marked.

- **Area schedule showing full GFA** of building seeking certification.

- **Completed Scoresheet, AP Declaration & Submission Checkist**
- **All contained in 'Scoresheet & General Info' spreadsheet.**
- **Any relevant GBCSA correspondence, clarifications or approved alternatives** (TC's and CIR's).

UPDATING THE RATING TOOL

Green Star SA – Existing Building Performance was developed on the basis of information available at the time of its development. Some issues have not been addressed in Green Star SA – Existing Building Performance due to the following:

- Cost of undertaking assessment and concerns of the reliability and accuracy of data relevant to South Africa (e.g. embodied energy, Life Cycle Assessment etc.);
- Lack of clear benchmarks or guidelines relating to buildings; and
- Lack of standards of measurement in South Africa and availability of suppliers' data (e.g. material toxicity).

As more research is undertaken in the green building sphere, Green Star SA rating tools are updated to reflect new information, practices, tools and references.

Green Star SA rating tools may also be updated as a result of credit interpretations from the certification process. In these cases, the GBCSA reviews the credit and, if the new credit interpretation is adopted, the relevant Green Star SA rating tool and the associated Technical Manual is updated to reflect the change. All Green Star SA tools have an allocated release date and version number to reflect these changes.

Green Star SA rating tools may also be revised on the basis of stakeholder feedback.

Feedback on Green Star SA – Existing Building Performance

The GBCSA encourages feedback on all Green Star SA rating tools, including Green Star SA – Existing Building Performance.

Feedback and queries can be sent to ebp@gbcsa.zendesk.com for consideration by the GBCSA.

Green Star Certification

CREDIT SUMMARY TABLE

	CREDIT	POINTS AVAILABLE
MANAGEMENT		**20.5**
EB-MAN-1	Accredited Professional	1
EB-MAN-2	Certified Buildings	1
EB-MAN-3	Building Management	5
EB-MAN-4	Green cleaning performance	3.5
EB-MAN-5	Green leasing	6
EB-MAN-6	On-going monitoring and metering	2
EB-MAN-7	Learning Resources	2
INDOOR ENVIRONMENT QUALITY		**16**
EB-IEQ-1	Indoor air quality	5
EB-IEQ-2	Lighting comfort	2
EB-IEQ-3	Thermal comfort	2
EB-IEQ-4	Occupancy survey	2
EB-IEQ-5	Acoustic comfort	3
EB-IEQ-6	Daylight and views	2
ENERGY		**27**
EB-ENE-1	Energy consumption (GHCE)	25
EB-ENE-2	Peak electricity demand	2
TRANSPORT		**4**
EB-TRA-1	Alternative transportation	4
WATER		**12**
EB-WAT-1	Potable water management	12
MATERIALS		**11**
EB-MAT-1	Procurement and Purchasing	4
EB-MAT-2	Solid Waste Management	7
LAND USE & ECOLOGY		**5**
EB-ECO-1	Grounds-keeping Practices	4
EB-ECO-2	Community Facilities	1
EMISSIONS		**4.5**
EB-EMI-1	Refrigerants	2
EB-EMI-2	Legionella	1
EB-EMI-3	Storm Water	1.5
TOTAL	**(Points available excluding Innovation)**	**100**
INNOVATION (see overleaf)		

Green Star Certification

	CREDIT	POINTS AVAILABLE
INN-1	Innovative strategies & technologies	Up to 10
INN-2	Exceeding Green Star SA benchmarks	
INN-3	Environmental initiatives	

Glossary

Accredited Professional
A building professional who has attended the Green Star SA Accredited Professional- Existing Building training courses, has passed the associated examination and is registered with the Green Building Council of South Africa as an Accredited Professional for Existing Buildings.
Active Cooling/Heating
A heating or cooling process or system which consumes a form of primary energy to store, collect and distribute thermal energy in order to provide space heating or cooling within a building.
Active Solar Strategies
Roof mounted mechanisms that are utilized to actively collect the energy of sunlight for example photo-voltaic.
AFFL: Above Finished Floor Level.
Air Handling Unit (AHU)
Equipment that includes a fan or blower, heating and/or cooling coils, regulator controls, and condensate drain pans, and air filters.
Alternative Energy
Energy from a source other than the conventional fossil-fuel sources of oil, natural gas and coal.
American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)
See http://www.ashrae.org.
Asbestos
A naturally occurring soft fibrous mineral commonly used in fireproofing materials and considered to be highly carcinogenic in particulate form.
Assessor
A person or persons, independent of the GBCSA, independent of the existing building owner and facilities managers, nominated by the GBCSA, knowledgeable and with experience in the green building industry, or who has such other appropriate assessment qualifications as the GBCSA may from time to time determine.
Attenuation means the reduction of peak storm water flow
Baseline
A line serving as a basis, as for measurement, calculation of performance of an existing building in relation to a resource for example energy or water consumption.
Benchmarking
The process of comparing one's performance metrics to industry bests (the benchmark) or best practices from other similar buildings with relation to a resource for example energy or water consumption.
Biodiversity
Or Biological Diversity is the entirety of all living organisms which is the variety of life in all forms, levels and combinations in a region from all sources including, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part. The term also includes diversity within species, between species, and of ecosystems.
Biomass
Plant matter for example trees, grasses, agricultural crops or other biological material; and comprising of all other materials of recent plant or animal origin.
Building Envelope
The exterior surface of a building's construction: the walls, windows, roof and floor; also referred to as 'building shell'.
Building Maintenance Guide (BMG)
A detailed guide compiled for the use of the building owner or facilities manager on assessing and maintaining the building's services and external building fabric.
Building Management System (BMS)
The BMS automatically controls the building services systems to maintain temperature, humidity, ventilation rates and lighting levels to pre-determined load requirements and to provide safe, efficient operation of equipment.
Building Research Establishment Environmental Assessment Method (BREEAM)
The UK-based BREEAM green building rating system assesses the environmental performance of both new and existing buildings. See http://www.breeam.org.

Glossary

Building Users' Guide (BUG)
A simple and easy to use guide for the non-technical building user which, through practical recommendations, encourages the use of the green building features of the design which also recommends tenant considerations for achieving whole-building environmental performance.
Carbon Dioxide (CO2)
Odourless gas commonly sourced by respiration, and is the result of the oxidation (including active combustion and respiration) of carbon based substances; it has been widely used as a measure of the ventilation adequacy of a space; (a principal greenhouse gas)
Carbon Monoxide (CO)
This is an odourless gas that is given off during the process of incomplete combustion, to be found in parking basements for example. Breathing in of CO gas reduces the ability of the blood to absorb oxygen and can be fatal.
Chartered Institute of Building Services Engineers (CIBSE)
See http://www.cibse.org.
Chlorofluorocarbons (CFCs)
CFCs are refrigerants or blowing agents which cause ozone depletion when released in the atmosphere.
CIR
See Credit Interpretation Request.
Climate Change
The change expected to occur to the world's climate due to human activities that emit greenhouse gases, such as burning fossil fuel (cars and electricity generation) and deforestation.
CLO Constant
The CLO Constant refers to the clothing variable used to assess the Predicted Mean Vote (P.M.V.) It recognises that people are warmer if they are wearing more clothes. See Thermal Comfort.
Cogeneration
The simultaneous production of electrical or mechanical energy (power) and useful thermal energy from the same fuel/energy source.
Commissioning
The advancement of an installation from the state of static completion to full working order to the specified requirements. It includes the setting to work of an installation, the regulation of the system and the fine tuning of the system.
Constructed Wetland
It constitutes a human-made habitat for waterfowl and other forms of wildlife, often using grey-water or rainwater catchments' overflow.
Contaminant
A substance that is not naturally present in the environment or that is present in unnatural concentrations or amounts, and which can (in sufficient concentration) adversely alter an environment.
Contractor
The contractor or builder engaged to complete the scope of works for churn and alterations.
CSIR
Council for Scientific & Industrial Research – See http://www.csir.co.za.
Credit Interpretation Request
Credit Interpretation Requests are submitted prior to assessment by a project that clearly meets the Aim of Credit but does not adhere to the stated Credit Criteria of the relevant Technical Manual. CIRs are considered by the GBCSA with the consultation from the Technical Working Group and other independent consultants, and the resulting rulings may set precedent and be used to update Green Star SA rating tools.
Cross Ventilation
When air flows naturally along one or more breeze paths, between ventilation openings on opposing or adjacent walls of a space or via a combination of wall and roof openings.
Current Public Transport Record
A survey of public transport undertaken regularly by Local and District Municipalities as mandated by National Government.

Glossary

Daylight Factor (DF)
Is the proportion of internal luminance (light level) compared to the external luminance, expressed as a percentage. Daylight Factor represents the proportion of external light which illuminates a given internal surface.
Daylight Luminance (DI)
It is the luminance (light level) achieved from daylight.
Deemed to Satisfy
It is prescriptive provisions which satisfy performance requirements, or stated level of performance.
Department of Environmental Affairs and Tourism (South Africa)
See http://www.deat.gov.za.
Department of Health (South Africa)
See http://www.doh.gov.za.
Department of Transport (South Africa)
See http://www.dot.gov.za.
Department of Water Affairs (South Africa)
See http://www.dwa.gov.za.
DTS
See Deemed to Satisfy.
Ecology
A branch of science concerned with the interrelationship of organisms and their environment.
Ecosystem services
Are the beneficial functions provided by ecosystems, such as water quality regulation, nutrient cycling, soil fertility maintenance, regulation of the concentration of atmospheric gases, climate regulation through reduction of heat islands, flood retention, and cultural and recreational opportunities.
Ecological infrastructure
Is the nature based equivalent of built or hard infrastructure, and is just as important for providing services and underpinning socio-economic development. Ecological infrastructure includes, for instance, healthy mountain catchments, rivers, wetlands, coastal dunes, and nodes and corridors of natural habitat, which together form a network of interconnected structural elements in the landscape.
Ecosystem
It is an interconnected and symbiotic grouping of animals, plants, fungi and micro-organisms which sustains life through biological, geological and chemical activity.
Eligible Project
An existing building that complies with the requirements contained in the Green Star SA Eligibility section of this Technical Manual.
Emission Controls
Any measure that reduces emissions into air, water or soil. The most effective emission controls involve the redesign of the process so less waste is produced at the source.
Emissions
The release of gases, liquids and/or solids from any process or industry; liquid emissions are commonly referred to as effluents.
Environmental Impact
Any change to the environment, whether adverse or beneficial, wholly or partially resulting from human activity, industry or natural disaster.
Existing Building
The building seeking Green Star SA performance rating certification has to be occupied and operational for at least 12 months after practical completion.
EPA
Environment Protection Agency – See http://www.epa.gov.
GBCSA
See also Green Building Council of South Africa.
Gross Floor Area
See 'List of Areas', 'Technical Manual & Submission Guidance' Section.
GHG
See Greenhouse Gas.
Global Warming Potential (GWP)

Glossary

Global Warming Potential provides a measure of the potential for damage that a chemical has relative to one unit of carbon dioxide, the primary greenhouse gas.

Greenbelt Zones

Are zones or areas in or around a city where the removal of native vegetation is prohibited and/or parks and other open, undeveloped, and vegetated space is protected.

Green Building

A Building that incorporates as built or operational practices that significantly reduce or eliminate its negative impact on the environment and its occupants; an opportunity to use resources efficiently while creating healthier environments for people to live and work in.

Green Building Council of South Africa (GBCSA)

A national, not-for-profit organisation that is committed to developing an environmentally sustainable property industry for South Africa by encouraging the adoption of green building practices. See http://www.gbcsa.org.za.

Greenhouse Effect

(1) The warming of the earth's surface and lower atmosphere as a result of carbon dioxide and water vapour, which absorb and reradiate infrared radiation, in the atmosphere; (2) An intensification of this warming effect from human-induced increase in carbon dioxide and other greenhouse gases in the atmosphere from the burning of fossil fuels.

Greenhouse Gases (GHGs)

Trace gases such as carbon dioxide, water vapour, methane, and CFCs that are relatively transparent to the higher-energy sunlight, but trap the lower-energy infrared radiation.

Green Roof

This is a roof on which plants and vegetation can grow. The vegetated surface provides a degree of temperature insulation as well as retention, attenuation, and treatment of rainwater.

Green Travel Plan

A programme that facilitates promotes and encourages the use of alternative transport that is known as 'Green Transport', which relates to transport modes that assist in reducing the environmental impacts from conventional single-occupant vehicles used for commuting.

Grey water

Waste water recovered from basins, showers, washing machines and other water sources that do not contain food or human waste.

Grid

A term used to describe the network of wires and cables which transport electricity from a power plant.

Ground Water

A general term which is used to describe the water beneath the Earth's surface.

GWP

See Global Warming Potential.

Habitat

The natural home of an animal or plant; (2) or the sum of the environmental conditions that determine the existence of a community in a specific place.

Habitat Fragmentation

Habitat disruption where natural habitat is broken into small, relatively isolated sections.

Hardscape

Pavers, sidewalks, raised planters, retaining walls, site furnishings and other non-living design elements used to enhance landscaped areas.

Hazardous Waste

Waste that is particularly dangerous or destructive; specifically characterised by one or more of the following properties: ignitable, corrosive, reactive or toxic.

Heating, Ventilation and Air Conditioning (HVAC)

It is the Mechanical systems that provide heating, ventilation and air conditioning in buildings.

Heat Recovery Ventilation

Is a system that reclaims the heat from warm exhaust air exiting a building and uses it to pre-heat entering fresh air.

Glossary

HCFCs (Hydro chlorofluorocarbons)
HCFCs are found in refrigerants and blowing agents that cause ozone depletion when released in the atmosphere.
HFCs (Hydro fluorocarbons)
HFCs are commonly used to replace HCFC refrigerants and blowing agents to reduce the ozone depletion potential (ODP); however, HFC products have a high Global Warming Potential (GWP).
IEQ
See Indoor Environment Quality.
Luminance
The luminous flux incident on a unit area of a surface. The unit is the lux which is one lumen per square meter.
Independent Chair
A person independent of the GBCSA, nominated by the GBCSA, knowledgeable and with experience in the green building industry, who has such appropriate assessment qualifications as the GBCSA may from time to time determine who is responsible for reviewing the report of the Assessors prior to the Assessors making a recommendation to the GBCSA in respect of the existing building performance.
Independent Commissioning Agent
An experienced and qualified commissioning agent who carries out commissioning on behalf of the building owner or the tenant.
Indicators
(1) A measurement or reporting tool used to gauge how well a society is achieving its economic environmental and societal goals; (2) A species of plant or animal, or a community, whose occurrence serves as evidence that certain environmental conditions exist.*
Indoor Environment Quality (IEQ)
It covers issues such as indoor air quality, thermal comfort, illumination, daylight, views, acoustics and occupant control of building systems.
Intergovernmental Panel on Climate Change (IPCC)
UN agency set up to provide the decision-makers and others interested in climate change with an objective source of information about climate change. Its role is to assess on a comprehensive, objective, open and transparent basis the latest scientific, technical and socioeconomic literature produced worldwide relevant to the understanding of the risk of human-induced climate change, its observed and projected impacts and options for adaptation and mitigation.
Interdependent Projects
Projects that share services and amenities.
JBCC Contract
The JBCC- Joint Building Contracts Committee's Principal Building Agreement for the South African Construction industry
Justify
Where project teams are requested to provide justification for certain claims within the Green Star SA submission, the actual quantitative or qualitative impact of the specific claim must be clearly demonstrated in relation to the Green Star SA Technical Manual requirements in order to prove compliance. Quantitative demonstration should be via referenced calculations or simulations, whereas qualitative demonstration should be referenced by supporting documentation or evidence such as recognised standards, guidelines or research papers.
Landfill
An area where solid waste is deposited. In a suitable area, a hole in the ground is lined so that materials will not escape, and is filled with layers of rubble/waste as the waste is progressively deposited. When completely filled, it is typically capped and sealed.
Leadership in Energy and Environmental Design (LEED)
The US-based LEED Green Building Rating System® is a voluntary, consensus-based national standard for developing high-performance, sustainable buildings. See http://www.usgbc.org/leed.
Life Cycle
All phases associated with the life of a product (i.e. creation, distribution, sale, installation, use, care and disposal/reuse/recycle).

Glossary

Life Cycle Assessment (LCA)
An evaluation of the environmental effects of a product or activity holistically, by analysing the entire life cycle of a particular material, process, product, technology, service or activity. The LCA consists of three complimentary components: inventory analysis, impact analysis, and improvement analysis, together with an integrative procedure known as scoping.

Maintained illuminance
The average illuminance over the reference surface at the time maintenance has to be carried out by replacing laps and/or cleaning the equipment and room surfaces (if applicable).

Mechanical Ventilation
It is Ventilation systems which use fans or other electrically operated air movement devices to provide ventilation to a building. Wind driven turbine ventilators and mechanically operated windows are not classified as 'mechanical ventilation'.

Mechanically Assisted Natural Ventilation
It is Systems that rely, partially or fully, on fans to move non-conditioned air through a space.

MET Values
MET refers to human metabolic rate and corresponds to the amount of heat (sensible and latent) released from the human body. It is used to size air conditioning equipment and to assess the Predicted Mean Vote (PMV) when calculating thermal comfort.

Mixed-Mode Ventilation
A ventilation strategy that combines natural ventilation and mechanical ventilation, allowing the building to be ventilated either naturally or mechanically according to the season or ambient temperatures.

Mixed-Use Development
The use of a single building for different purposes simultaneously.

Mould
Mould is a fungus that typically grows in a filamentous cobweb-like mass under damp conditions and is capable of producing staggering numbers of reproductive spores in as little as a few days. Moulds are non-chlorophyll containing entities, which require organic matter, living or dead, for survival. Moulds are extraordinarily diverse in character and their relationship with humans span the positive (e.g. food, antibiotics) to the negative (e.g. pathogens, antigens, toxins).

Natural Ventilation
The process of supplying and removing air in building spaces by natural means, by using openings in the façade (e.g. windows), non-powered ventilators, solar chimneys and infiltration processes. A building can still be termed 'naturally ventilated' if it contains propeller type ceiling fans provided they only cause recirculation of air.

O&M Manual
Operations and Maintenance Manual

Occupied Space
Areas that are predominantly: Work spaces (e.g. cellular offices, open plan offices, meeting rooms, food preparation areas, laboratories, consulting rooms, workshops - small scale and high density it work spaces); Large event spaces (e.g. dry sports halls, swimming pool areas, halls, arts theatres, libraries, assembly areas, sales areas – general, performance areas (stage), check in areas, fitness suites, gyms, fitness studios); and Learning spaces (e.g. classrooms and lecture rooms) are all expected to form part of the Occupied Space.
Common areas and corridors are to be excluded from the calculation of Occupied Space unless they are designed to include permanent occupation such as workspaces. Occupied Space also excludes enclosed fire stairs, storage areas, toilets, tea kitchens, changing facilities, bathrooms, display areas, IT equipment rooms and plant-rooms.

ODP
See Ozone Depleting Potential.

OHS
Occupational Health & Safety.

Operational Maintenance is maintenance of equipment using procedures that require detailed technical knowledge of the equipment's or system's function and design including all preventive maintenance

Glossary

Organisation for Economic Co-operation and Development (OECD)
See www.oecd.org.
Ozone (O3)
A naturally occurring, highly reactive, irritating trace gas comprising of tri-atomic oxygen formed by recombination of oxygen in the presence of ultraviolet radiation.
Ozone Depletion
Destruction of the Earth's ozone layer, which can be caused by the photolytic breakdown of certain chlorine and/or bromine-containing compounds (e.g. chlorofluorocarbons), which catalytically decompose ozone molecules.
Ozone Depleting Potential
ODP provides a measure of the potential damage that a chemical has relative to that of refrigerant type CFC11. CFC11 has an ODP of one and is the most damaging of CFCs.
Ozone Hole
A thinning break in the ozone layer. Designation of the amount of such depletion as an 'ozone hole' is made when the detected amount of depletion exceeds 50%. Seasonal ozone holes have been observed over the Antarctic and Arctic regions, part of Canada, and the extreme northeast United States.
Ozone Layer
The protective layer in the stratosphere layer of the atmosphere, about 24 kilometres above the ground that absorbs some of the sun's ultraviolet rays, thereby reducing the amount of potentially harmful radiation that reaches the earth's surface.
Passive Cooling/Heating
A process of cooling/heating a building in which no power or fuel is consumed. This is distinct from natural ventilation, which relates only to air supply and extract, although natural ventilation may provide passive cooling in some weather conditions. Other examples of passive cooling include cooling from thermal mass, while passive heating strategies include heating using solar gains through windows and reducing infiltration to prevent heat escaping.
Passive Design
Interventions implemented that reduces the energy consumption of a building by taking advantage of natural heating, cooling and lighting.
Passive Solar Design
Interventions implemented that uses the inherent characteristics of a building rather than mechanical systems to capture heat and light from the sun.
Peak Flow (also known as 'peak discharge') is the maximum rate of flow of water passing a given point during or immediately after a rainfall event.
Performance Period
The Existing Building Performance certification application includes performance data for the building and site over the performance period—the continuous, unbroken time during which sustainable operations performance is being measured. The performance period may not have any gaps, defined as any period of time longer than 1 full week.
Photovoltaics
The introduction of semiconductor technology to generate electricity directly from the sunlight.
Pollution
Generally, the presence in the environment of a substance that, because of its chemical composition or quantity, prevents the functioning of natural processes and produces undesirable environmental and health effects; can be seen as the human-induced alteration of the physical, biological, chemical and radiological integrity of water and other media.
Potable Water
It is water that is drinkable therefore safe to be consumed.
Practical Completion
The stage of completion where the works or a section thereof, as certified by the principle agent, is substantially complete and can effectively be used for the purpose intended (JBCC Series 2000).
Precipitation is the water received from atmospheric moisture as rainfall, hail, snow or sleet, normally measured in millimetres depth

Glossary

Preventative Maintenance
The care and servicing by building/facilities managers for the purpose of maintaining equipment and facilities in satisfactory operating condition by providing for systematic inspection, detection, and correction of emergent failures either before they occur or before they develop into major defects.
Recyclable
Commonly referred to as the ability of a product or material to be recovered from, or otherwise diverted from, the solid waste stream for the purposes of recycling.
Recycled Content
Materials that have been recovered or otherwise diverted from the solid waste stream, either during the manufacturing process (pre-consumer) or after consumer use (post-consumer). Pre-consumer material does not include materials normally reused by industry within the original manufacturing process, and is also termed 'post-industrial'.
Recycling
A process, by which materials that would otherwise become waste are collected, separated or processed and returned to the economic mainstream to be reused in the form of raw materials or finished goods.
Regularly Occupied Spaces
See 'Occupied Space'
Relative Humidity RH)
The ratio of the amount of water vapour in air at a specific temperature to the maximum capacity of the air to hold moisture at that temperature.
Relevant Existing Building Team Member
A member of the Existing Building Performance Team; no specific profession or skills are required for the purpose of 'Documentation Requirements'.
Remediation
Efforts to counteract some or all of the effects of pollution after it has been released into an environment.
Renewable Energy
An energy source that, from an earth perspective, is continually being replenished.
Renewable Resources
Resources that can be replenished at a rate equal to or greater than its rate of depletion (for example solar, wind, geothermal and biomass resources).
Retrofitting (storm water)
The modification or installation of additional or alternative storm water management devices or approaches in an existing developed area in order to achieve better management of storm water.
RH
See Relative Humidity
Service Level Agreement (SLA)
Part of a service contract where a service is formally defined.**South African Bureau of Standards (SABS)**
See http://www.sabs.co.za
South African National Standard (SANS)
Standards written by SABS which are normally not mandatory unless referenced by legislation, such as SAN 10400 National Building Regulations
South African Institute of Architects (SAIA)
See http://www.saia.org.za
South African Property Owners Association (SAPOA)
See http://www.sapoa.org.za
Statement of Confirmation
Formal confirmation from the required party. This may take the form of any formal written correspondence such as a signed letter, facsimile or electronic correspondence (email) provided that the sender's company details and email signature is displayed.
Suitably Qualified Professional
A person suitably experienced by profession, training, or demonstrable experience, to calculate, confirm, commit or provide comment on, the field, subject or topic as required for the purpose of 'Documentation Requirements/Evidence' as necessary.

Glossary

Sustainable Development
An approach to progress that meets the needs of the present without compromising the ability of future generations to meet their needs.* (Bruntland et al.1986).
Supporting Documentation
With reference to 'Documentation Requirements'; other documentation submitted within the same credit of a submission.
Storm Water Runoff
Runoff generally refers to the excess water that flows after precipitation
Technical Working Group (TWG)
An advisory panel convened by the GBCSA and designated as the 'Technical Working Group'.
Tenancy Fit-out Guide (TFG)
A detailed guide for the design team responsible for the fit-out containing information on the green building features of the base building and recommendations on how to achieve the green building potential of the tenancy.
Thermal Comfort
Is a method of describing occupant comfort which takes into account air temperature, radiant temperature, humidity, draught, clothing value and activity rates.
Thermostatic Control
A device which measures the room temperature and automatically switches the heating/cooling system on and off according to the set point temperature which can be adjusted by the occupant(s).
Timer Control
A device which allows the occupant(s) to set times at which a specific system (e.g. geyser or HVAC system) is switched on and off. Both one day (24 hour) and 7 day time-clock controls are available, the latter allowing different settings to be used at weekends.
Ventilation
The process of supplying and removing air in building spaces by natural or mechanical means.
Visual Light Transmittance (VLT)
Refers to the amount of visual light a material allows to be transferred through itself.
VOC
See Volatile Organic Compounds.
Volatile Organic Compounds (VOCs)
VOCs are organic compounds that produce vapours readily at room temperature and normal atmospheric pressure.
Waste Management Plan (WMP)
A document which outlines how solid waste can be collected for recycling and recycled, and how the recycling of that waste has to be recorded.
Water Table
This is the upper most level of the zone of saturation below the Earth's surface, except where this surface is formed by an impermeable body.
WC
Water closet (toilet).
WHB
Wash Hand Basin.
Work Setting
A table or workstation with a chair. Tables which have more than one chair provided are considered to be equivalent to one work setting for each two chairs provided.
Xeriscape
A water-conserving landscape or landscape installation requiring no additional watering. For Green Star SA purposes, it is acceptable to irrigate a xeriscape garden during the first year, but once established the landscape must not be irrigated.

EB-MAN-1 Accredited Professional

POINTS AVAILABLE **1**

CONDITIONAL REQUIREMENT

AIM OF CREDIT

To ensure the involvement of qualified individuals who will direct and assist the owner/ facilities management team with the integration of Green Star SA aims and processes throughout the performance period.

CREDIT CRITERIA

Green Star SA Existing Building Performance AP	1 point is awarded where a principal participant in the existing building team is a Green Star SA Existing Building Performance Accredited Professional

DOCUMENTATION REQUIREMENTS

Submit all the evidence and ensure it readily shows compliance,

Criteria	Documentation
Green Star SA AP - Existing Building Performance	• **Proof of Accreditation** Green Star SA EBP AP Accreditation certificate OR Print-out of the relevant web-page of GBCSA GSSA EBP AP Directory
	• **Statement of confirmation** from the Building Owner Representative

Proof of accreditation must take the form of either:
• A copy of the nominated Green Star SA Existing Buildings Accredited Professional's accreditation certificate;
OR
• A printout of the relevant page of the online Green Star SA Existing Building Accredited Professional Directory, to be found on the GBCSA website.

Statement of confirmation from the Building Owner in the form of formal correspondence (signed letter, facsimile or email with company email signature and date of issue), confirming the engagement of a Green Star SA Existing Building Accredited Professional as an employee or by appointment:
• Detailing the date of engagement/appointment (i.e. dates from/to); and
• Describing their scope of works and confirming that they have provided guidance to the existing building's performance rating team regarding, or were responsible for, the Green Star SA submission compilation.

To be deemed 'engaged', in line with the Aim of Credit, the Green Star SA Accredited Professional must contribute substantially to the rating of performance of the existing building and the submission compilation. Where the Green Star SA Existing Building Accredited Professional's scope of works is outlined in a job description or fee proposal provided to the Building Owner, upon which they are engaged, the fee proposal may be submitted to demonstrate the 'scope of works' aspect of the 'Statement of Confirmation', provided

the fee proposal is referenced in the signed 'Statement of Confirmation', or the fee proposal itself is signed by the Building Owner.
Should the role of the Green Star SA Accredited Professional be fulfilled by different individuals throughout the performance period, the evidence listed under Documentation Requirements must be submitted for each Accredited Professional. Where the 'Statement of Confirmation' makes reference to the company appointed for Accredited Professional services, and not the individual Accredited Professionals, a signed letter from the appointed company must be provided listing all individuals fulfilling the role of Accredited Professional on the specific existing building's performance rating.

ADDITIONAL GUIDANCE / RESOURCES

Green Star SA Accredited Professional Existing Building Performance Courses:
This is currently formatted as a 3 part programme which provides a comprehensive overview of the GBCSA Green Star SA rating system for Existing Building Performance tool which is intended for the objective measurement and rating of the on-going environmental performance of existing buildings. It provides insight into all major aspects that should be considered for the improvement of the environmental performance of these buildings. The programme consists of the following three parts:

- an online course,
- a live workshop and
- an online exam,

This culminates in the Green Star SA Accredited Professional – Existing Building Performance (GSSA AP EBP) accreditation which equips the professional with the knowledge of how to use the Existing Building Performance PILOT tool. Format: The online course gives an in depth, technical understanding of the tool and the workshop gives a high level overview and a good sense of the application of the tool. Both of these components can be done as standalone courses and can be completed in an order of preference of the participant.

To be eligible to write the exam one needs to have completed both the online course and the workshop. Individuals to attend are: Facilities managers, Sustainability Consultants, Engineers, Architects, Property Owners, Developers and Tenants

Green Star SA Accredited Professional Existing Building Performance Database-

http://www.gbcsa.org.za/gbcsa-education/

REFERENCES & FURTHER INFORMATION

Green Building Council of South Africa
http://www.gbcsa.org.za

https://www.gbcsa.org.za/network/directories/accredited-professionals/

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

EB-MAN-2 Certified Buildings

POINTS AVAILABLE **1**

AIM OF CREDIT

To reward buildings that have shown previous environmental achievement through Green Star SA* Design/As Built or Interiors certification.

CREDIT CRITERIA

Certified Buildings	1 point is awarded if the building already has a Green Star SA* Design/As Built or Interiors certification (Interiors certification of >50% of GLA).

**Or similar under a rating tool recognised by an established Green Building Council.*

DOCUMENTATION REQUIREMENTS

Submit all the evidence and ensure it readily shows compliance,

Criteria	**Documentation**
GSSA Design/As Built or Interiors Certification	**Copy of GSSA Certificate**
	Complete and upload submission template

ADDITIONAL GUIDANCE

Potential Green Star Certification strategies: it would be possible for an existing building owner to firstly pursue a Refurbishment Green Star SA Design Rating or As Built rating if a substantial Green Building refurbishment is done prior to the performance period. The following Green Star Rating Tools are available for new buildings and refurbishments as well as interior fit-outs in new and existing buildings:

Green Star SA-Office V1

Green Star SA-Retail Centre V1

Green Star SA- Multi-Unit Residential V1

Green Star SA- Public & Educational Building V1

Green Star SA- Interiors V1

Certain information approved in previous certifications will be deemed acceptable as documentation requirements for this performance rating assessment. Such documentation should be motivated by the project team via Credit Interpretation Request.

BACKGROUND

Green Star SA certification during building design and construction indicates that building owners have already taken significant steps to protect the environment and conserve valuable resources, in addition to making available healthy indoor environments for building occupants. Green Star-certified buildings deliver many economic benefits, such as reduced operating costs, enhanced asset value, improved productivity of building occupants, and optimized life-cycle economic performance. On average, Green Star certified buildings should use 25- 50% less energy than conventional buildings,

which would result in a significant decrease in operational costs. Rebates, incentives, and long-term savings based on life-cycle cost assessments help discharge the initial investments in pursuing Green Star certification. Recent market studies including operational analysis of certified buildings in the USA (LEED) and Australia (Green Star- Australia) have however shown that not all buildings have performed according to design/ as built predictions. The actual reduced costs of operating the building and improved economic performance by reduction of water and energy consumption will therefore be confirmed in terms of conserving resources and reducing Greenhouse Gas Emissions if the building does perform as predicted.

REFERENCES & FUTHER INFORMATION

Web-Sites:
Green Building Council of South Africa
http://www.gbcsa.org.za
The GBCSA web-site provides case-study information of buildings that certified with Green Star ratings

Printed Media:
LEED Reference Guide for Green Building Operations and Maintenance for the Operations and Maintenance of Commercial and Institutional Buildings 2009 Edition (Updated April 2010)
LEED Canada for Existing Buildings: Operations and Maintenance 2009

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

EB-MAN-3 Building Management

POINTS AVAILABLE 5

AIM OF CREDIT

To recognize management and operating processes and procedures used to optimize building environmental performance.

CREDIT CRITERIA

Building Operations Manual	**2 points** are awarded where a Building Operations Manual has been produced and is actively used as a guide for operating building systems efficiently and managing resources effectively.
Building Users' Guide	**1 point** is awarded where a simple and easy-to-use Building Users' Guide has been produced and issued to users, occupants and tenants. If the requirement for a Building Users' Guide has been satisfied under the Green Star SA Design / As-Built certification, this point will be automatically be awarded.
Maintenance Management	**1 point** is awarded where there is evidence of an Operational Maintenance Planning Schedule for building assets and equipment during the performance period. The scope of this document must at a minimum cover systems with significant energy or water consumption impacts, E.g.: • Major electrical and lighting systems and controls • HVAC systems • Water pumping systems (incl. fire protection) • Vertical Transportation Systems e.g. lifts
Tuning process	**1 point** is awarded where a tuning process addressing nominated systems are in place during the performance period.

These credit requirements shall apply to the base building only. I.e. only building services and systems under the control of the building management team.

COMPLIANCE REQUIREMENTS

A. BUILDING OPERATIONS MANUAL

The Building Operations Manual shall include but not be limited to the following items:

- Asset registers (Information presented up to system level and not component level. For example, for a centralised air-conditioning system, only the Air Handling Unit (AHU) will be indicated on the asset register and not the AHU Fan Motor (which may be described as a component or subsystem of an AHU system).

- Schedule of up to date As-Built drawings (Note: This is including all building systems/services)
- Commissioning data (for building not older than 5 years). Commission data must cover at least [75%] of the following systems (by installed kW size):
    - HVAC system (main plant and air-handling units)
    - Water supply system: main pump(s)
- Building materials and finishes schedules. Include materials and finishes used during the performance period in any building alteration or maintenance.
- Operating procedures (operating times, service request management, help desk information, etc.)

B. BUILDING USERS' GUIDE

The Building Users' Guide must be a concise and user-friendly document, suitable for a layperson. It is not intended as a supplementary document to the Operations & Maintenance Manual for maintenance staff, and as such must not include detailed information on maintenance and spare parts, etc.

Simplified diagrams are aimed, and intended, for the use of the building occupants and need to communicate the depicted service/system in a very basic and clear way that can be readily understood by the general public. Any drawing/diagram that contains technical detail generally is not considered to be "simplified".

For basic function and operation, it is not necessary to describe the function of simple amenity taps, or lighting systems without automatic control features. The intent of providing information on basic function and operation is only intended for those systems whose use and operation may not been immediately intuitive to building occupants. For example, the basic functions of a lighting system that includes daylight sensors or occupancy sensors would need to be described, however a lighting system with only simple manual controls (i.e. on/off switches) would not.

The Building Users' Guide must include links to online information such as websites, publications, and organisations relating to energy and water conservation, efficient building operation, indoor air quality or sick building syndrome, and environmental design features.

The provision of a building Operation and Maintenance (O&M) manual does not meet the Building Users' Guide requirement. The O&M manual typically only provides detailed specialist information required by building manager and staff/contractors, not information intended for occupants.

The Building Users' Guide, at a minimum, must include the following sections and information:

Energy & Environmental Strategy:

- Descriptions of the initiatives intended to enhance energy efficiency (and associated greenhouse gas emissions), water efficiency and indoor environment quality;
- Descriptions of performance benchmarks or targets which the building complies with for the purposes of Green Star SA certification; and,
- Quantification of the potential water, energy and greenhouse gas emissions, and financial (i.e. operational) savings.

EB-MAN-3 Building Management

POINTS AVAILABLE 5

Monitoring and Targeting:

- Outline of the energy and water targets or benchmarks for the building;
- Descriptions of the automated energy and water metering strategy for the building (if applicable);

In compiling the Building Users' Guide and noting Monitoring and Targeting initiatives for Indoor Environmental Quality, project teams may address (but are not limited to) the following:

An explanation of the importance of good Indoor Environmental Quality and the related benefits:

- Benchmarks and monitoring initiatives for Carbon Dioxide Monitoring;
- Benchmarks and monitoring initiatives for Thermal Comfort;
- Benchmarks and monitoring initiatives for Day-lighting Measures;
- Any other relevant data that may be extracted from and/or controlled by, that building's Building Management System and;
- Any other relevant information, aligned with the Green Star SA Indoor Environmental Quality initiatives the project has employed and/or is targeting.

Building Services:

Descriptions of the basic function and operation, and simplified system diagrams, of the building services including, at a minimum:

- Heating, ventilation, air-condition and cooling (HVAC) system
- Electrical system;
- Lighting system; and,
- Domestic hot water system.

Transport Facilities:

- Descriptions of the car parking requirements and provision of cyclist facilities, conditions of access, and appropriate use; provided these are available within the building.
- Overview of local public transport information, maps and links to timetables; for transport available within the building's [150 m] radius and,
- Details on alternative methods of transport to the workplace, such as car-sharing and carpooling, bicycle paths etc.

Materials & Waste & Recycling:

- Information on recycling, including what can be recycled, where the waste storage areas are, and the schedules for waste and recycling removal;
- Information on any other waste management processes present such as composting or worm farm facilities (where applicable), as well as schedules for waste and recycling removal.

Community Facilities:

- Where the project has included community facilities, descriptions of on-site community facilities provided their location and instructions for use.

Landscape Management and Biodiversity Features

- Descriptions of the site landscape and biodiversity features;

Expansion/Re-fit Considerations and Preferred Materials

- Recommendations for materials or products which do not compromise indoor environment quality such as: Construction materials with zero or low VOC emissions
- Recommendations for materials or products with improved sustainability performance (e.g. recycled content material, FSC certified timber, etc.).Include a list of environmental recommendations for consideration, highlighting in particular the areas typically covered by fit-out projects. Consider examples such as use of environmentally friendly materials, reuse of other materials, etc.

C. MAINTENANCE MANAGEMENT

An **Operational Maintenance Planning Schedule** should refer to operational expenditure items only and should contain (at least) planned preventative types of maintenance activities

Only tasks with frequencies of one month or more should be shown in the Operational Maintenance Planning Schedule.

The Operational Maintenance Plans Schedule must indicate the building equipment, asset, material affected and the corresponding maintenance task or activities planned (showing the month in which a particular activity is scheduled) during the performance period.

The operational maintenance planning schedules required for this submission are limited to the main equipment and subsystems. Below are some examples of equipment types and subsystems applicable, mapped to different maintenance tasks / activities.

Example1: Electrical and Electronic Equipment Maintenance Plan

Equipment / Subsystem	Maintenance Activity / Task1	Frequency of Maintenance Activity / Task	Month Scheduled
MV Switchgear (2 units)	Major equipment service	2 yearly	Sept 2013
Standby Diesel Generator xxx kVA	Engine major service	Annually	July 2013
Standby Diesel Generator xxx kVA	Alternator and auxiliaries service	Annually	July 2013
Standby Diesel Generator xxx kVA	Generator on-load test and inspection	3 monthly	July 2013 [1]Nov 2013 [2]

Other examples of electrical and electronic equipment:

- Transformer

- Uninterruptible Power Supply (UPS)
- Building Management System (BMS)

Example 2: Mechanical Equipment Maintenance Plan

Equipment / Subsystem	Maintenance Activity / Task1	Frequency of Maintenance Activity / Task	Month Scheduled
Air conditioning – Ducted Split Units (xx units)	Minor equipment service	Monthly	Jul 2013 Aug 2013 Sep 2013
Water Treatment Plant	Water testing, chemical dosing and system inspection	Monthly	Jul 2013 Aug 2013 Sep 2013

Other mechanical equipment examples:

- Domestic water tanks and pumps
- Chillers

Fire Protection Systems

- Sprinkler suppression
- Firefighting equipment (extinguishers, water hose reels)

Example 3: Annual maintenance planning schedule

System or Equipment	Type of Maintenance	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HVAC – Chiller 1	Monthly service	■	■	■	■	■	■	■	■	■	■	■	■
HVAC – Chiller 1	Annual service						■						
HVAC – AHU 1	Monthly service	■	■	■	■	■	■	■	■	■	■	■	■
HVAC – AHU 2	Monthly service	■	■	■	■	■	■	■	■	■	■	■	■
HVAC – Data centre split unit 1`	Monthly service	■	■	■	■	■	■	■	■	■	■	■	■
Electrical – MV transformer	Annual oil sampling and analysis											■	

Fire protection – Portable extinguisher & hose reels	Annual equipment service			■									

D. TUNING PROCESS

The nominated services for this credit shall include (but not limited to):

- HVAC systems
- Building Management Systems (BMS)

A tuning process includes an initial audit of the existing system, followed by reporting and an action plan leading to continuous monitoring, system testing, corrective action response, on-going measurement and appropriate documentation.

A Tuning Process Document must be produced to include (but not limited to):

- **Roles and responsibilities** clearly outlined for each of the parties involved in delivering tuning and maintenance
- **Measurement requirements** (I.e. BMS points, metering system, data access)
- **Review techniques** used to evaluate and identify performance of monitored points and associated systems
- **An action plan for correction** of operational issues and deficiencies
- **Frequency of analysis**
- **Production of periodical reports on the performance** of nominated building systems

DOCUMENTATION REQUIREMENTS

Criteria	Documentation
All	• **Completed Submission Template**
Building Operations Manual	• **Building Operations Manual** including: o Asset registers o Schedule of As-built drawings o Commissioning data (for buildings not older than 5 years) o Materials and finishes schedule o Operating procedures

EB-MAN-3 Building Management

POINTS AVAILABLE 5

Building Users Guide	• **Building User Guide** including: ○ Energy and Environmental Strategy ○ Monitoring and Targeting ○ Building Services ○ Transport Facilities ○ Materials and Waste Recycling ○ Community Facilities ○ Landscape Management and Biodiversity Features ○ Expansion/Re-fit Considerations and Preferred Materials
Operational Maintenance Planning Schedule	• **Operational Maintenance Planning Schedules** for planned preventative maintenance of operational expenditure items.
Tuning Process Document	• **Tuning Process Document** signed off by the relevant Facilities Management representative.

BACKGROUND

Environmental performance of existing buildings relies on effective operations and management of buildings systems. For many buildings in South Africa the responsibility to operate, maintain and improve performance of building systems is given to a Facility or Facilities Manager.

Basic facilities management practices have been outlined in this credit. By complying with them, the building can realise environment and economic performance envisaged.

REFERENCES& FUTHER INFORMATION

GBCSA Green Star SA Public and Education Building Design / As Built Rating Tool,

Green Seal
http://www.greenseal.org/GreenBusiness/InstitutionalGreeningPrograms/GreenBuildingOperationsMaintenance.aspx

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

EB-MAN-4 Green Cleaning Performance

POINTS AVAILABLE **3.5**

AIM OF CREDIT

To encourage high performance cleaning practices, which reduce the exposure of building occupants and maintenance personnel to potentially hazardous chemicals, biological and particulate contaminants that compromise indoor environmental quality, human health, building fabric and the natural environment.

CREDIT CRITERIA

Green Cleaning Policy	1 point is awarded where: The applicant develops and implements a compliant Green Cleaning Policy during the performance period. This Green Cleaning Policy must be in line with the Green Star SA Policy Model (available on the Certification Engine).
Purchase of Green Cleaning Consumables	Up to 2 points are awarded as follows: 1 point is awarded where the top three (3) cleaning consumables (by cost) purchased by the project during the performance period each have: • had 'Declaration Questionnaires'* completed by their suppliers, and • based on this information, achieved a score of at least 30 in the MAT-4 'Cleaning Consumables Scorecard'* **Declaration Questionnaire and Scorecard available on the Certification Engine for this credit.* OR 2 points are awarded where the top three (3) cleaning consumables (by cost) purchased by the project during the performance period each comply with at least one of the Sustainability Standards listed for the particular product category.
Cleaning Audit	0.5 points are awarded where a cleaning audit is carried out in accordance with the stipulated guidelines and a score of 3 or less is obtained. (MAN-4 Green Cleaning Audit Calculator available on Certification Engine)
Areas Not Under The Control Of Building Management	The criteria set out within this credit applies to the areas that are under the control of the building management team with respect to cleaning (as set out within the lease agreement). AND For areas that are not under the control of the building management team with respect to cleaning (e.g. tenant areas),

	a tenant guideline document* must be issued which details the following: • Recommendations for the use of green cleaning consumables in line with the credit criteria.

PERFORMANCE PERIOD
The performance period for all components of this credit is six months.

GREEN CLEANING POLICY

NB. Although it is not necessary for organizations seeking certification to develop separate policies, projects are required to highlight - and where not present in existing policies, amend these to include - all elements of the Green Star SA Policy Model as well as the requirements outlined below.

A Green Cleaning Policy must be in place for the building(s) and site, which must be in line with the Green Star Policy Model and to cover, at a minimum, the following requirements:

- Standards and Performance Measurements and Metrics:
  - Stipulate that the purchase and use of green cleaning chemicals has to meet the credit requirements: Purchase of Green Cleaning Consumables
  - Stipulate the environmental performance measurements, metrics and goals relating to green cleaning products

- Implementation Procedures and Strategies
  - Clearly set out the Standard Operating Procedures which outline the implementation of cleaning practices at the project building(s)
  - Clearly set out the processes for handling and storing cleaning chemicals
  - Develop appropriate strategies for protecting vulnerable population groups (occupants most affected by harmful chemicals, e.g. asthmatics and sufferers of other respiratory disorders, elderly, etc.)

- Quality Assurance Control Processes
  - Stipulate the quality assurance control system that must be in place to ensure the implementation of the green cleaning policy, to include a regular facility and process inspection, such as by means of a structured cleaning audit.
  - Include green cleaning performance specific wording in tender documentation and/or service level agreements that clearly identifies the responsibility
  - Develop a training plan for cleaning staff
  - Develop an occupant feedback collection system

The Green Cleaning Policy can be an existing, company-wide policy that covers, with at a minimum, the above requirements and implemented on an individual building level. Although the policy does not have to be developed specifically for the purpose of Green Star SA Performance certification, adherence to the Green Star Policy model is required.

PURCHASE OF GREEN CLEANING CONSUMABLES

The use of common cleaning chemicals poses a potentially potent threat to indoor air quality and the health and wellbeing of building occupants and cleaning and maintenance personnel. In addition, many common cleaning consumables, such as paper products, may use substantial amounts of virgin materials in their production.

EB-MAN-4 Green Cleaning Performance

POINTS AVAILABLE **3.5**

This credit component rewards projects that during the performance period procure cleaning chemicals and consumables, which meet sustainability criteria as outlined below.

Points	Compliance criteria: Cleaning Consumables Scorecard
1 point	The top three cleaning consumables (by cost) purchased by the project (or used by the cleaning contractor) during the performance period must each: • have Declaration Questionnaires* completed by their suppliers, and • based on this information, achieve a score of at least 30 in the MAT-4 Cleaning Consumables Scorecard*

Or

Points	Compliance criteria: Sustainability Standards
2 points	The top three cleaning consumables (by cost) purchased by the project (or used by the cleaning contractor) during the performance period must each comply with at least one of the Sustainability Standards listed under tables Man-4 below for the particular product category.

Where the key three cleaning consumables meet a combination of Option 1 and Option 2, a maximum of 2 points can be earned, provided that at least 2 consumables meet Option 2, otherwise 1 point is earned.

Instructions to meet compliance:

All Options

Step 1:

- Identify the top three key cleaning consumables by cost procured during the performance period.
- Provide written confirmation from the cleaning contractor (or owner representative, as applicable) that the green cleaning consumables used to document compliance are the top three consumables by cost procured during the performance period

Option 1: Cleaning Consumables Scorecard

Step 2

- Distribute the 'Cleaning Chemical Declaration Questionnaire' to the suppliers of the top three cleaning chemicals highlighted above. Note that the chemical supplier / manufacturer is to complete this checklist, not the contractor.
- Review the requirements for scoring cleaning products as per the instructions in Additional Guidance. Based on the information provided in the completed 'Declaration Questionnaires', complete the 'Cleaning Consumables Scorecard' and confirm that the top three cleaning consumables each score at least 30 points.

Option 2: Sustainability Standards

Step 2

Review the standards in Tables MAN-4.1 – MAN-4.5 below in the section: Additional Guidance.

EB-MAN-4 Green Cleaning Performance

POINTS AVAILABLE **3.5**

Confirm that the three key cleaning consumables meet the required standard in their product category.

Obtain evidence, such as documentation from product manufacturers or suppliers verifying product compliance with the specified sustainability criteria (See Documentation Requirements).

CLEANING AUDIT

In order to assess the effectiveness of a cleaning programme, conduct regular cleaning audits of the entire facility that assess, at a minimum, the appearance level of the facility.

An appearance level assessment must be done in accordance with the assessment guidelines* in the 'MAN-4 Green Cleaning Audit Calculator' available on the Certification Engine.

A score will be assigned according to the audit outcome and an average score of 3 or less must be obtained.

** These guidelines have been based on the APPA Leadership in Educational Facilities' Custodial Staffing Guidelines.*

DOCUMENTATION REQUIREMENTS

Submit all the evidence and ensure it readily shows compliance.

Criteria	Documentation Requirements
All	• **Completed Submission Template** Complete the submission template and append the following documents as prompted within the template.
Green Cleaning Policy	• **Copy of the Green Cleaning Policy.** Provide a copy of the Policy and complete the submission template to clearly show compliance.
Purchase of Green Cleaning Consumables	• **Signed Confirmation* of Top-3 Consumables** Provide signed confirmation from either a facilities management representative or the cleaning contractor that the green cleaning consumables used to document compliance are the three key consumables by cost procured during the performance period. **Signed letter, facsimile or email with company email signature and date of issue.* • **For 1 point , submit:** o **Completed Declaration Questionnaires** for each of the top 3 products. o **Material Safety Datasheets (MSDS)** for each of the top 3 products. o **Completed Cleaning Consumables Scorecard** for each of the top 3 products • **For 2 points, submit:** o **Technical Data Sheets** Provide the technical data sheets confirming sustainability standards have been met for the top three cleaning consumables procured during the performance period.
Cleaning Audit	• **Audit Calculator Spreadsheet** Complete the audit calculator provided, confirming scores for each audited space type.

Areas not under Building Management Control	• **Tenant Guidelines** Copy of issued guidelines recommending the use of green cleaning consumables in line with the credit criteria.

ADDITIONAL GUIDANCE & BACKGROUND

The commercial contract cleaning industry in South Africa has low-level entry requirements while being a highly competitive industry sector. Although the industry is highly regulated, the cleaning staff in particular are often exposed to high levels of harmful chemicals that are commonly found in many cleaning products. If not managed and controlled well, ongoing exposure to such chemicals by cleaning staff and building users/occupants, either through inhalation or skin absorption, can increase adverse health risks, such as reproductive problems and eye, skin and respiratory irritation. If not disposed of properly, cleaning products can also have negative environmental impacts including air and water pollution, accumulation of toxic substances in plants and animals, endocrine disruption in wildlife, and ozone depletion. Used correctly, green cleaning products and green cleaning practices can help to reduce many of these health and environmental hazards.

GREEN CLEANING CHEMICALS

Green cleaning products can make a contribution to both improving the indoor environment in buildings and lowering the impact on air, water and ecosystems. Many cleaning chemicals are derived from non-renewable resources and often pose significant threats to human and environmental health. Using certification standards to vet and approve what constitutes green cleaning chemicals approved for use in buildings reduces the risk of 'green-washing' and ensures that chemicals are thoroughly tested - according to internationally established standards - for toxicity to aquatic life, bio-degradability, contribution to eutrophication, air quality degradation and other factors related to human and environmental health.

OPTION 1: CLEANING CONSUMABLES SCORECARD

See 'Declaration Questionnaire' and 'Consumables Scorecard' available from Certification Engine under this credit.

OPTION 2: PRODUCT SUSTAINABILITY CRITERIA:

The tables below stipulate the sustainability criteria for cleaning products, disinfectants, metal polishes and other products generally used in commercial cleaning operations.

Table MAN-4.1: Cleaning Products

Cleaning products must meet **at least one** of the following standards:

Product category	Category Specific Standards	Alternative Applicable Standards
General-purpose, bathroom, glass and carpet cleaners used for industrial and institutional purposes	Green Seal GS-37	Any Type 1 eco-labeling program as defined by ISO 14024: 1999 developed by a member of the Global Eco labeling Network *OR*

Cleaning and degreasing compounds	Environmental Choice CCD-110	Any Certification Scheme classified as Level A, B or C under the GBCSA's 'Assessment Framework for Certification Schemes'. (see www.gbcsa.org.za) *OR* EPA Design for the Environment Program's Standard for Safer Cleaning Products *OR* Cleaning devices that use only ionized water or electrolyzed water
Hard-surface cleaners	Environmental Choice CCD-146	
Carpet and upholstery care	Environmental Choice CCD-148	
Industrial and institutional floor care products	Green Seal GS-40	
Hard-floor care	Environmental Choice CCD-147	

Table MAN-4.2: Disinfectants, metal polish, or other products not addressed by Table MAN-4.1

Disinfectants, metal polish, or other products not addressed by Table MAN-4.1 must meet one or more of the following standards:

Product category	Category Specific Standards	Alternative Applicable Standards
Digestion additives for cleaning and odour control	Environmental Choice CCD-112	California Code of Regulations maximum allowable VOC levels for the specific product category *OR* EPA Design for the Environment Program's Standard for Safer Cleaning Products *OR* Cleaning devices that use only ionized water or electrolyzed water and have third-party-verified performance data equivalent to the other standards mentioned in this table[1] *OR* Any Type 1 eco-labeling program as defined by ISO 14024: 1999 developed by a member of the Global Eco Labeling Network *OR* Any Certification Scheme classified as Level A, B or C under the GBCSA's 'Assessment Framework for Certification Schemes'. (see www.gbcsa.org.za)
Drain or grease trap additives	Environmental Choice CCD-113	
Odour control additives	Environmental Choice CCD-115	
Specialty cleaning products	Green Seal GS-52/53	

Table MAN-4.3 Disposable cleaning paper products and rubbish bags

Disposable cleaning paper products and rubbish bags meet the minimum requirements of one or more of the following programmes for the applicable product category:

Product category	Category Specific Standards	Alternative Applicable Standards

[1] if the device is marketed for antimicrobial cleaning, performance data must demonstrate antimicrobial performance comparable to EPA Office of Pollution Prevention and Toxics and Design for the Environment requirements, as appropriate for use patterns and marketing claims

Tissue paper, paper towels and napkins	Green Seal GS-01	Maintenance/cleaning paper products derived from rapidly renewable resources or made from tree-free fibres *OR* FSC certification, for fibre procurement *OR* Paper products, such as bathroom tissue, facial tissues and paper towels have recovered and post-consumer recycled content recommendations as per Table MAN-4,4 *OR* Any Type 1 eco-labeling program as defined by ISO 14024: 1999 developed by a member of the Global Eco labeling Network *OR* Any Certification Scheme classified as Level A,B or C under the GBCSA's 'Assessment Framework for Certification Schemes'. (see www.gbcsa.org.za)
Toilet tissue	Environmental Choice CCD-082	
Hand towels	Environmental Choice CCD-086	
Specialty cleaning products	Green Seal GS-52/53	

Table MAN-4.4 Recommended recovered fibre content levels for maintenance/cleaning and hygiene paper products

Item	Recovered Fibre (%)		Post-consumer Fibre (%)
Toilet tissue	20-100	of which	20-60
Paper towels	40-100		40-60
Facial tissue	10-100		10-15
Paper napkins	30-100		30-60
General purpose industrial wipes	40-100		40

Table MAN-4.5 Hand Soaps

Hand soaps should not contain any anti-microbial agents (other than as a preservative) except where required by health and other regulations (e.g. food industry, health care requirements).

Product category	**Category Specific Standards**	**Alternative Applicable Standards**
Industrial and institutional hand cleaners	Green Seal GS-41	Any Type 1 eco-labeling program as defined by ISO 14024: 1999 developed by a member of the Global Eco labeling Network *OR* Any Certification Scheme classified as Level A,B or C under the GBCSA's 'Assessment Framework for Certification Schemes'. (see www.gbcsa.org.za)
Hand cleaners and hand soaps	Environmental Choice CCD-104	
Hand sanitizers	Environmental Choice CCD-170	

Building Audits and Building Cleanliness

Building Cleanliness is often associated with the health and well-being of occupants. In well-cleaned and well-maintained facilities, occupants report fewer health problems and through cleaning audits, facility managers can identify weaknesses in the cleaning programme and improve the indoor environment.

EB-MAN-4 Green Cleaning Performance

POINTS AVAILABLE 3.5

REFERENCES & FURTHER INFORMATION

WEB-SITES

EPA Design for the Environment Program's Standard for Safer Cleaning Products:
http://www.epa.gov/dfe/pubs/projects/formulat/saferproductlabeling.htm

Environmental Choice Certified Products
www.ecologo.org

Green Seal Certified
www.greenseal.org

Global Eco Labelling Network
www.globalecolabelling.net

Carpet and Rug Institute
www.carpet-rug.org

APPA: Leadership in Educational Facilities
www.appa.org

PRINTED MEDIA

USGBC, Leadership in Energy and Environmental Design (LEED) – Existing Buildings: Operations and Maintenance Reference Guide, 2009.

OTHER DOCUMENTATION (NOT PUBLISHED)

Hotel Verde, Supplier's Guide for the Sustainable Procurement of Goods and Services: Cleaning Operations, Cape Town 2013.

Hotel Verde, Cleaning Operations Scorecard, (excel spreadsheet), Cape Town 2013

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

EB-MAN-5 Green Leasing

POINTS AVAILABLE **6**

AIM OF CREDIT

To recognise and encourage collaboration between building owner and occupants in order to manage and operate the building along environmentally sustainable principles whilst realising mutual benefit.

CREDIT CRITERIA

Cost & benefit sharing mechanisms	**1 Point** is awarded where a cost sharing and benefit sharing mechanism is agreed for capital greening initiatives or interventions undertaken during the performance period.
Inclusion of Green Lease criteria to new leases & renewals	**1 Point** is awarded where the building owner drafts a standard commitment to be negotiated with all new tenants and upon tenant renewals requiring: • Fit-out Requirements as set out within this credit • Management & Operations Requirements as set out within this credit
Tenancy fit-out and alterations	A maximum of **1 point** is awarded where a signed agreement is in place between building owner and tenant during the performance period, in order to ensure that fit-out design and construction for the occupied rentable space meets the intended sustainability objectives (see 'Fit-out Requirements' below). Points are achieved as shown in the table below:

Total tenanted Gross Lettable Area (GLA) covered by signed agreement(s)

Type of agreement signed	**20%**	**50%**
Min. Mutual Disclosure Agreement	0.5 point	1 point

Management and operations	A maximum of 3 **points** are awarded where the building owner has a signed agreement with the tenant during the performance period, in order to ensure that occupied rentable space is operated and managed in compliance with the intended sustainability objectives (See 'Management & Operations Requirements' below). Points are achieved as shown in the table below:

Total tenanted Gross Lettable Area (GLA) covered by signed agreement(s)

Type of agreement signed	**15%**	**30%**	**50%**
Min. Mutual Disclosure Agreement	1 point	2 points	3 points

Owner Occupied Buildings:

EB-MAN-5 Green Leasing

POINTS AVAILABLE **6**

Where no leasing arrangement exists for the building (e.g. owner-occupied buildings), or where areas under a lease agreement make up less than 30% of the building GLA, this credit can be claimed as '**Not Applicable**'.

Alternatively, for projects where a lease agreement is not in place, an owner commitment or inter-departmental agreement can substitute the Green Lease. For instance, building owners can commit to any of the Requirements below through internal targets that are set and measured by the on-going performance of the building. This formal commitment must address all criteria set out for the relevant point targeted.

Cost sharing mechanism

Where there have been any capital greening projects or initiatives during the performance period, reward is given where a formalised signed agreement between the building owner and the tenant is in place to address the capital contributions by both parties in relation to any green initiatives or interventions that will be conceptualised or implemented during the performance period, as well as the sharing of the associated savings/benefits of such initiatives. Where no capital greening initiatives have taken place in the performance period, the point may be claimed as 'Not Applicable'.

Inclusion of Green Lease criteria to new leases & renewals

The building owner is to drafts a standard commitment (in compliance with both the Fit-out Criteria and Management & Operations Criteria of this credit) and commit to be negotiating this agreement with all new tenants and upon tenant renewals.

Fit-Out Requirements:

Points are awarded where the tenant is committed to the following environmental considerations for any fit-out work in the building:

- Specification of energy efficient lighting and appliances, and agreement on a targeted energy consumption level for the space. Reporting on how these areas are achieved within the fit-out must be provided to the landlord;
- Specification of water efficient fixtures and fittings (where applicable), and agreement on a targeted consumption level for the space. Reporting on how these areas are achieved within the fit-out must be provided to the landlord;
- Waste reduction/recycling requirements during fit-out construction, a waste management plan to be provided to the landlord including recycling targets and reporting on these targets to the landlord;
- Sustainability considerations for materials specified. Reporting on how these areas are achieved within the fit-out must be provided to the landlord;

Management & Operations Requirements:

Points are awarded where the owner/landlord demonstrates that the tenant is committed to ongoing performance that requires the tenant to participate in the following environmental initiatives while occupying the space:

- Electrical energy monitoring & reporting* (minimum quarterly) and a requirement to submit an energy management plan to the landlord;
- Water monitoring & reporting* (minimum quarterly) and a requirement to submit a water management plan to the landlord;

- Waste reduction/recycling monitoring & reporting (minimum quarterly) and a requirement to submit a waste management plan to the landlord. Where waste recycling is done for all occupant waste streams in a single facility by the landlord, the tenant need only show waste management of waste which they are responsible for managing, e.g. re-use of printer/toner cartridges, hazardous waste, e-waste, etc.

AND

The building owner is required to report back to the tenants on the buildings performance relating to energy, water and waste on an annual basis.

DOCUMENTATION REQUIREMENTS

Submit all evidence and ensure it readily confirms compliance; also complete submission template. The following documents are required:

Criteria	**Documentation**
All	• **Completed Submission Template** Complete the submission template and append the following documents as prompted within the template.
Cost Sharing Mechanism	• **Signed Agreement** between owner and tenant detailing the cost and benefit sharing mechanism.
Inclusion of Green Lease criteria to new leases & renewals	• **Extract from Standard Lease Agreement** highlighted to demonstrate compliance with the credit criteria, or; o **an Addendum or Annexure to the Lease Agreement or;** o **Special Conditions to the Lease Agreement** • **Signed Confirmation* from Building Owner** that 'Green Lease' clauses will be negotiated with all new leases or lease renewals. **Signed letter, facsimile or email with company email signature and date of issue*

Fit-out & Management & Operations Commitments	• **Schedule of Compliant Leases/Commitments** Sizes (m²) and current tenants of compliant green leases in place, tallying the total percentage of the GLA covered by these leases. • **Extracts from the Signed Agreements** highlighted to demonstrate compliance with the credit criteria, or; ○ **an Addendum or Annexure to the Lease Agreement or;** ○ **Special Conditions to the Lease Agreement**

ADDITIONAL GUIDANCE

Please refer to GBCSA Green Lease Toolkit for further information regarding benefits, formation and specific application of a green lease. (http://www.gbcsa.org.za/knowledge/publications/?cat=98)

BACKGROUND

What is the Goal of a Green Lease?

The fundamental concept that underpins a green lease is that of mutual understanding. While the details may vary from one agreement to another, the primary purpose of a green lease is:

- To improve the operational performance of green buildings; and
- To deliver to landlords and tenants an equitable share of the incremental value provided by green buildings.

A green lease seeks to achieve these goals by securing long-term operational performance through a transparent, mutually beneficial agreement between tenants and landlords that governs:

- The base building and fit-out quality in buildings;
- The contractual requirements of facilities managers;
- The behaviour of tenants from an environmental perspective; and
- Regulation of governing bodies (through continuing education).

What is a Green Lease?

'Green Lease' is a general term that describes a document for negotiating green building attributes between the owner and the tenant of a building. It does not necessarily refer only to a lease agreement but could also represent:

- A Service Level Agreement (SLA)
- Memorandum of Agreement (MOA)
- Lease annexures
- Special lease terms and conditions
- Building/property/facility management guidelines or rules

EB-MAN-5 Green Leasing

POINTS AVAILABLE **6**

A green lease is an adaptation of a traditional lease. It is primarily a set of legally binding rights and obligations - a contract. The parties both agree that the landlord will provide the temporary use and enjoyment of the premises in return for the payment of rent by the tenant. It must contain the essential terms of a contract and, in particular:

- There must be consensus on the essential elements of the contract;
- Both parties must have the capacity to enter into the contract;
- Performance of the contract must be physically possible; and
- It must include any legal formalities such as the length of the lease and lease termination requirements.

The key difference with a green lease is the assignment of responsibilities and financial obligations related to occupying and owning a green building. The responsibilities to do, and to pay, are often split. Typically, the tenant carries the responsibility to pay and the landlord the responsibility to do. Please refer to GBCSA Green Lease Toolkit for any other information regarding benefits, formation and application of a green lease.

REFERENCES & FURTHER INFORMATION

GBCSA Green Lease Toolkit, South Africa 2012

The Green Lease Handbook, Council of Australian Governments (COAG), 2012
http://www.gbca.org.au/gbc_scripts/js/tiny_mce/plugins/filemanager/Green-Lease-Handbook-20120907-PDF.pdf

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The Real Property Association of Canada
http://www.realpac.ca

Jones Lang LaSalle, Perspectives in sustainable tenants strategies, 2013
http://www.joneslanglasalle.co.za/GSP/en-gb/Documents/GSP/GreenLeases-10reasonswhyyoushouldhaveone.pdf

Green Lease – Commercial Lease Arrangement s for Sustainable Buildings
http://www.ogierproperty.com/commercialproperty/commercialguides/greenleasescommercialleasearrangementsforsustainablebuildings/

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http://www.pinsentmasons.com/PDF/DevelopmentofGreenLeasees.pdf

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

EB-MAN-6 Ongoing Monitoring and Metering

POINTS AVAILABLE **2**

AIM OF CREDIT

To recognize operational practices which facilitate effective ongoing monitoring and metering of water and energy consumption.

CREDIT CRITERIA

Basic Monitoring Strategy	0.5 points are awarded where metering is provided for major energy consumption uses of the building for the performance period AND There is an effective mechanism for monitoring the consumption data. 0.5 points are awarded where metering is provided for major water consumption of the building for the performance period AND There is an effective mechanism for monitoring the consumption data.
OR	
Advanced Monitoring Strategy	1 point for energy and/or 1 point for water are awarded where: • Metering is provided for major energy consumption and/or water consumption uses of the building for the performance period, AND • There is an actively implemented automated mechanism for monitoring the consumption data (trending, logging, etc.)

Monitoring Distinct Uses
The monitoring strategy must cover relevant areas or functions of a building. In most cases floor by floor metering will suffice if the entirety of the floor is a single use.

Where a landlord and tenant relationship exists, it would be acceptable for the monitoring strategy developed by the building owner to take into account each individual tenanted space.

Major energy uses
Major electrical loads that warrant sensible and beneficial sub-metering to achieve energy savings that could be sub-metered include (but are not limited to):

- Car park ventilation and lights
- Chiller-HVAC plants
- Hot water plants for space heating
- Air handling fans
- Lifts / escalators
- Domestic hot water plants with a combined storage of 1000 litres or more

As a general guideline all loads greater than 100kVA should be independently monitored and metered.

Major water uses
Major water uses are defined as items or spaces that individually account for at least 10% of the building's total water use.

Examples of major water uses include, but are not limited to:

- Evaporative heat rejection systems, such as cooling towers
- Landscape irrigation systems

- Wash down systems
- Humidifiers
- Food preparation areas

Basic monitoring strategy
A basic monitoring strategy, developed for the premises under investigation must be in place during the performance period to be eligible for points in this credit. This strategy can make use of manual meter reading, monitoring and reporting.

The monitoring strategy must identify:

- which meters are in place and operational (existing and planned)
- how meters should be read
- by whom meters should be read
- how often meters should be read
- how this process is managed and verified

The monitoring strategy must also include a metering schedule and sample report from within the performance period. This schedule and report must address the loads for energy and water consumption. It must outline:

- The incoming inputs (electricity, gas, water, etc.)
- The end-uses (lighting, HVAC, fans, tenancy)
- Which meter(s) provide the required information
- The consumption for the metered end-uses

The monitoring strategy, once implemented and operational, must easily allow at least the top 3 energy consumers and the top 3 water consumers to be easily identified by facilities management teams. Top consumers could include tenants and/or plants and must be identified as such. In multi-tenanted buildings the top 3 tenants as well as the top 3 plants (if applicable) should be highlighted. The monitoring strategy should allow for the trending of present performance parameters against previous performance to monitor improvements.

Where renewable energy and water reuse or harvesting is taking place, these must be measured and indicated separately.

Advanced monitoring strategy
An advanced monitoring system is regarded as an automated monitoring system that records both consumption and demand (energy only) of either energy or water via live, on-line meters. These systems are capable of processing the information to produce reports for definable periods (hourly, daily, monthly, etc.) for individual as well as groups of meters. Advanced monitoring system meters are characterised as being capable of recording values and producing an output that can be transmitted to a central location (onsite or offsite) that can provide data retrieval and reporting mechanisms.

The system must be capable of:

- Collecting data from all meters;
- Alerting to missing data due to failures
- Processing data on energy use or water consumption at user adjustable intervals
- Automatically notifying the Facility Management when the energy or water use increases beyond certain parameters
- Providing a breakdown of the information by building system (mechanical, electric, etc.), or by space (or by tenanted floor)

- Including the consumption of water, or the consumption of energy, the load versus time (load profile), and the power factor (in the case of energy)
- Producing, as a minimum, a quarterly report for the facilities manager responsible for the building

Meter Accuracy and Accessibility
Meters can either be read manually (for basic) or automatically (for advanced), via a remote meter reading system

A policy requirement must be in place to conduct a meter audit to calibrate meters at least every 5 years.

The audit should include, as a minimum:
- Confirmation of meter accuracy
- Confirmation and verification of CT ratios
- Calibration certificates / test reports stating validity period

DOCUMENTATION REQUIREMENTS

The following documentation/evidence is required for this credit; submit all evidence and ensure it readily confirms compliance; also complete online submission template/check list

Criteria	Documentation
All	• **Completed Submission Template**
Basic Monitoring Strategy	For 1 point (0.5 for energy and 0.5 for water) upload: • **Meter Audit Policy requiring calibration** at least every 5 years. • **Copy of basic metering strategy** document. • **Electrical system line diagrams and/or meter schedule** indicating the end-uses metered. • **Sample metering data summary report** (consumption and trending indicated).
Advanced Monitoring Strategy	For up to 2 points (1 for energy and 1 for water) upload: • **Meter Audit Policy requiring calibration** at least every 5 years.

	• **Copy of advanced metering strategy** document detailing functionality of the system as well as methods of reporting. • **Electrical system line diagrams and/or meter schedule** indicating the end-uses metered. • **Sample metering data summary report** (consumption and trending indicated).

ADDITIONAL GUIDANCE / RESOURCES

Confirming installed meter accuracy

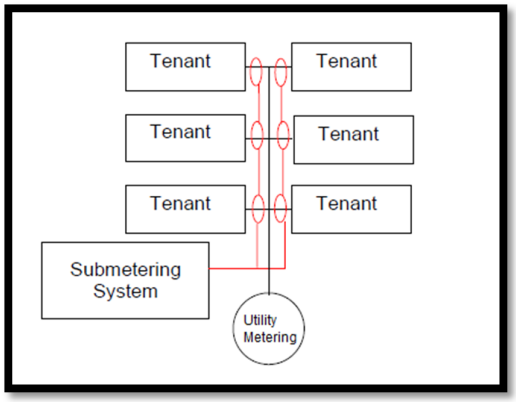
The following methods to confirm meter accuracy can be used:

1. Calibration of meters according to SANS 474:2006 (preferred)
2. Power logging with calibrated instrument for a sample period of time
    a. Comparing on-line pre-paid meter data with logged data
3. Comparing installed meter readings (instantaneous) with a calibrated test instrument's readings
4. Comparing installed water meter readings (instantaneous) with a calibrated ultrasonic flow meter or check water meter

Metering Systems Examples

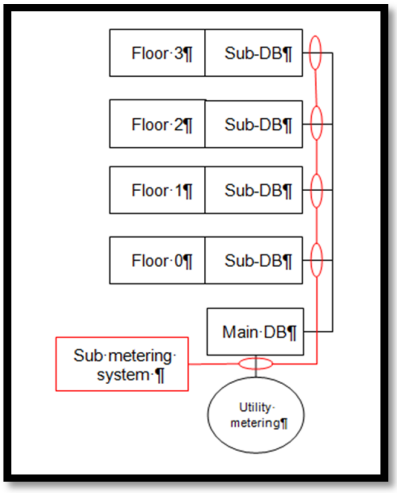
The following examples of metering are provided for guidance:

The figure below illustrates a typical tenant sub-metering system with a single utility meter. Each tenant area is sub-metered for billing prepossess.



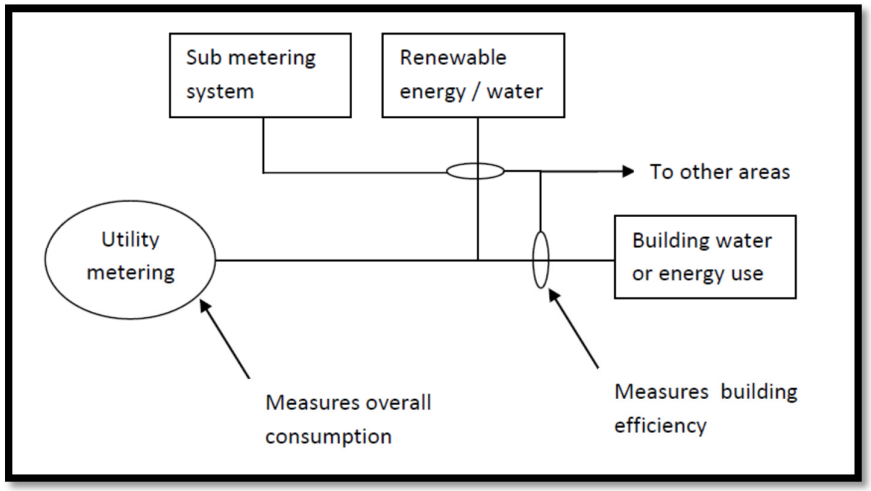
Example1-Subsystem metering

The diagram below illustrates a typical high-rise building environment with different tenants on each floor. Sub-metering is provided on each sub-DB as well as on the main DB. The latter can be used as a verification tool for the main utility meter. A similar layout will be employed if more than one tenant occupies a particular floor, i.e. each tenant area will be equipped with a meter.



Example 2- Subsystem metering with central verification meter

The figure below illustrates how renewable energy and water must be separately measured along with any sub-metering systems.



Example 3 – Measure for building efficiency

Additional guidance on energy sub-metering in non-domestic buildings can be found in the CIBSE TM39 Building Energy Metering guide issued by Chartered Institution of Building Services Engineers (CIBSE).

EB-MAN-6 Ongoing Monitoring and Metering

POINTS AVAILABLE **2**

BACKGROUND

Electricity tariffs and charges – financial incentive to monitor

Building electricity bills are normally made up of three components:

- Max demand (kVA)
- Actual usage (kWh)
- Connection size levy

Accurate monitoring and metering of utilities will not only allow trends and problem areas to be identified, but enable building owners to make informed decisions regarding tariff plans (e.g. reduced rates after peak hours, awareness of max demand penalties, etc.). Historical data analysis can also lead to the realisation that legacy electrical connection sizes are excessive and savings can be realised by reducing the connection size and thus the connection levy.

Meter accuracy and accessibility

Meters should be capable of measuring kVA as well as kWh to reap maximum benefit from the information. Both the SANS 50001document as well as the Eskom M&V protocol document can also be used as a guideline.

Benefits of sub-metering

The old adage “you can't manage what you don't measure” applies to sub-metering and the effective control of energy and water usage in buildings.

The information contained in Utility bills is retrospective by nature and aggregated over the entire billing period obscuring patterns of use and usage areas. Sub-metering addresses this information gap by providing real-time, granular visibility of energy and water use. The main advantages of sub-metering include:

- Identification of unnecessarily running loads (e.g. over weekends, at night)
- Real-time feedback on implemented strategies
- Comparison and benchmarking of usage
- Detection of utility bill errors and wastage
- Better management of energy and water usage to limit Utility imposed penalties (e.g. notified maximum demand)

EB-MAN-6 Ongoing Monitoring and Metering

POINTS AVAILABLE **2**

REFERENCES & FURTHER INFORMATION

1. **SOUTH AFRICAN NATIONAL STANDARD.** *SANS 474:2006 Code of practice for electricity metering.* Pretoria : SABS, 2006.

2. **SOUTH AFRICAN NATIONAL STANDARD**. *SANS 50010:2011 Measurement and verification of energy savings .* Pretoria : SABS Standards Division , 2011.

3. **Green Star Australia.** Green Star - Performance . Sydney : s.n., 2013.

4. **SOUTH AFRICAN NATIONAL STANDARD.** *SANS 50001:2011 Energy managment systems - requirements with guidance for use.* Pretoria : SABS Standards Division , 2011.

5. **Eskom M&V Guidelines**. http://www.eskom.co.za/IDM/MeasurementVerification

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

EB-MAN-7 Learning Resources

POINTS AVAILABLE **2**

AIM OF CREDIT

To encourage and recognise initiatives undertaken to facilitate sustainability awareness and education amongst building occupants and visitors.

CREDIT CRITERIA

Physical Displays	1 Point is awarded where within the building or the broader site, physical displays are provided for building occupants and visitors such that: • A minimum of one sustainability initiative implemented in the building related to Energy is described and displayed, and the resulting energy use and greenhouse gas emissions are continuously presented; AND • A minimum of one sustainability initiative implemented in the building related to Water is described and displayed, and the resulting potable water savings are continuously presented; AND • A minimum of one sustainability initiative implemented in the building not related to energy or water is described and displayed, and the resulting benefit(s) are presented.
Awareness Programmes	1 Point is awarded where there has been a structured sustainability awareness or education programme in place for building occupants during the performance period.

Physical Displays

Sustainability initiatives must be displayed as follows:

- A description must be provided with a clear explanation of what the initiative is, how it works, and what is the expected sustainability benefit resulting from its inclusion in the project scope.
- A display must be provided which could include but is not limited to the use of educational display boards, signage or posters, exhibits, screens, cutaway sections of the building fabric, audio, etc. This display must be of sufficient size to be prominent in its position and easily identified. Typically this could be of an A1 size or larger.
- Energy & Water savings must be presented and regularly updated (period between updates not longer than 1 month) i.e. screens, signs or educational display boards used should have the functionality for energy and water savings to be displayed and updated on a regular basis.
- Displays must be located in prominent accessible locations. Typically this could include reception and waiting areas, entrances, atria or exhibition areas. Displays can also be located next to the sustainability initiative (e.g. outside the building next to rainwater collection tanks or photovoltaic panels). When this is the case, signage directing building users to these areas must be provided in locations where all of the building occupants and visitors can see them.

EB-MAN-7 Learning Resources

POINTS AVAILABLE **2**

Awareness Programmes

For the purposes of this credit, an Awareness Programme must meet the following criteria:

- Must consist of regular (minimum quarterly) communication of sustainability focused content to building occupants and management staff. I.e. Internal communication of content.
- At a minimum within the performance period, topics covered should include Energy Efficiency, Water Efficiency and Waste Management
- Content can be delivered via channels such as training, workshops, newsletters, etc.
- Communication regarding the awareness programme must be accessible to all building occupants and staff.

DOCUMENTATION REQUIREMENTS

Submit all the evidence and ensure it readily shows compliance,

Criteria	Documentation
Physical Displays	• **Complete Submission Template**
	• **Letter of confirmation** from Facility Management
	• **Photographic evidence**
Awareness Programmes	• **Complete Submission Template**
	• **Signed statement from Programme Manager**

Letter of confirmation from Facility Management:
A signed confirmation is to be provided by a member of the Facility Management team confirming:

- That a display(s) have been installed and that energy and water savings have been updated and displayed regularly during the performance period.

Photographic Evidence:
Photographs of the displays must be included to show that Energy, Water and a minimum of one other sustainability initiative is addressed.

Signed Statement from Programme Manager:
The person responsible for managing the Awareness Programme must provide a signed statement which:

- Summarises the programme
- Confirms that it has been in operation throughout the performance period
- Confirms that content was delivered at least quarterly
- Confirms that the programme was communicated to and made available to all building occupants

ADDITIONAL GUIDANCE / RESOURCES

Physical Display Examples
The following are examples of how sustainability initiatives can be described and presented to the public. The energy and water features must present both a description and continuous update of savings as outlined overleaf:

EB-MAN-7 Learning Resources

POINTS AVAILABLE **2**

Energy

Sustainability initiative:

- The project features a renewable energy source such as photovoltaic panels with the capacity to provide a certain amount of energy to the building, resulting in a significant reduction of greenhouse gas emissions.

Description:

- An educational display board is provided explaining what the initiative is, how the photovoltaic panels work, and what the expected sustainability outcome is.

Location:

- The educational display board is permanently mounted on a wall in the reception area of the building.

Display of continuous updates on energy savings:

- The project has smart metering installed, thus 'real-time' data is presented. A screen displaying the energy being produced by the photovoltaic panels, and the equivalent savings in greenhouse gas emissions in real-time is permanently located next to the educational display board.

Water

Sustainability initiative:

- The project features a rainwater collection system that distributes rainwater to be used for flushing toilets, cooling towers and irrigation.

Description:

- Educational display boards are provided explaining what the rainwater system is, how it works and the expected water savings. The display boards include drawings, diagrams and other relevant information about the system.

Location:

- Educational display boards are placed near rainwater collection tanks, toilets where rainwater is used and clear distribution pipes are installed, showing rainwater being transported. Signs directing occupants and visitors to these features are provided in accessible locations.

Display of continuous updates on water savings:

- A screen displaying potable water savings resulting from the operation of the system is located next to at least one of the educational boards. The screen is linked to a Content Management System that allows water savings to be manually updated on a daily basis. More screens may be located in other visible areas of the building.

Other

Sustainability initiative:

- The building in the project incorporates double glazing to some extent. The sustainability initiative of the building enhances the thermal comfort of the occupants and reduces the energy consumption.

Description:

- A static display consisting of a cut away section of double glazed window fitting showing the frame and glazing sections together with educational display boards explaining the environmental benefits of the double glazing for the occupants of the building. The educational display board will indicate the effect on occupant thermal comfort due to the double glazing as well as a schematic view and easy to understand workings of solar heat gain, visual transmittance and thermal conductivity and how these properties are tempered by the installation of double glazing resulting in improved environmental performance.

Location:

- The static display is in the central foyer or reception area or main recreational area (e.g. canteen) within the building, as such making it visible to all building occupants.

Awareness Programmes

One of the most important factors in the environmental performance of a building is behavior change among occupants. Awareness programmes are a crucial means to ensuring tenant, occupant and staff buy-in and behavior change.

Some suggested approaches to be included within the Awareness Programme include:

- Presentations on initiatives being undertaken in the building
- Basic sustainability training and workshops
- Tenant 'operations greening' workshops
- Building management staff training
- Newsletters on interesting events, initiatives and resources relating to sustainability
- 'Market Days' for suppliers of environmentally preferable products and services

BACKGROUND

In the developed world, people typically spend 90% of their day within buildings. This means that the built environment has huge potential to reach and educate its occupants. Making environmental building initiatives and features visible and interactive can provide a valuable education and learning opportunity for building users to develop awareness about the building's impacts on the natural environment and resources.

By incorporating important concepts such as energy, water and material efficiency, buildings become the everyday catalyst for change in occupant behavior.

REFERENCES & FURTHER INFORMATION

BREEAM Schools
http://www.breeam.org/page.jsp?id=20.

Collaborative for High Performance Schools (CHPS) (2006), High performance schools best practice manual – Volume 1 Planning http://www.chps.net/manual/documents/

BPM_2006_Edition/CHPS_I_2006.pdf.Griffith University Eco-centre,
http://www.griffith.edu.au/environment-planning/ecocentre.

Innovative Design, Sustainable school guidelines – Buildings that teach sustainability,
http://www.innovativedesign.net/pdf/03bldgteach.pdf.

Sims, J.K. (2001), 'Green Schools: A Design Fad or a Trend Worth Embracing?', in School Planning and Management, March, 2001, http://www.peterli.com/spm/index.shtm.

Steele-Saccio, E. (2007), 'Education by Design', in GOO D Magazine, 13 August, 2007,
http://www.goodmagazine.com/section/Features/education_by_design.

EB-MAN-7 Learning Resources

POINTS AVAILABLE **2**

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

EB-IEQ-1 Indoor Air Quality

POINTS AVAILABLE **5**

AIM OF CREDIT

To recognize the monitoring and control of indoor pollutants and thus help sustain the comfort and well-being of building occupants.

CREDIT CRITERIA

IAQ Manager	**1 point** is awarded where an IAQ manager is appointed who supervises and manages the optimization of practices that prevent and minimize the build-up of indoor pollutants in buildings.
System performance	**1 point** is awarded where it is demonstrated, through a high level inspection by a suitably experienced person that • Appropriate filters are installed and maintained in all duct systems to avoid any dust infiltration through the air inlets. • A positive pressure is maintained in the occupied spaces to ensure no dust infiltration takes place through the building envelope • Fresh air intakes are positioned in locations in order to avoid the intake of outdoor pollutants. • The air distribution system is sufficiently circulating outdoor air to all occupied spaces. Where any of the above items are not suitable, a corrective action programme must be documented, to achieve the point.
Indoor Air Quality Testing	**Up to 3 points** are awarded where annual testing of indoor air quality is carried out in regularly occupied spaces and parking areas for the following: • carbon monoxide (CO) levels in covered parking areas must not exceed 26ppm for at least 70% of the measured spaces for **1 point** • carbon dioxide (CO_2) levels in regularly occupied areas must not exceed: **1 point** – 1000ppm for min. 70% of the measurements taken **2 points** – 800ppm for min. 70% of the measurements taken Where the specified limits are exceeded (26ppm and 1000ppm respectively for >70% of measurements), a corrective action plan must be documented and **½ point** can be achieved. This is applicable to both CO and CO_2 separately.

EB-IEQ-1 Indoor Air Quality

POINTS AVAILABLE **5**

DOCUMENTATION REQUIREMENTS

Criteria	Documentation
All	• **Completed Submission Template**
IAQ (Indoor Air Quality) Manager	• **IAQ Management Plan** detailing the following (see section below for further detail): o Assignment, Responsibilities and Training o Establishing an Adequate IAQ Baseline o Written Plans and Protocols o Communications Programs o Quality Assurance and Inspections
System Performance	• **Audit Report** confirming: o Suitably installed and maintained filters. o That all fresh air intakes are suitably positioned away from any pollutant sources. o That the building is under positive pressure. o That the fresh air is suitably distributed to all occupied spaces. • **Corrective Action Plan**, w7 here required.
Indoor Air Quality testing	• **Sample Test Results** for CO & CO2 (min 10 spaces) • **Corrective Action Plan** (where required)

IAQ MANAGER

At the start of the performance period, appoint an individual as the IAQ manager. The role of the IAQ manager can be fulfilled by the Facilities Manager or another member of the building management team, whether in-house or contracted-in.

The Responsibilities of the IAQ manager shall be contained in the IAQ Management Plan and as a minimum include the following:

- The IAQ Manager shall prepare the IAQ Management Plan.
- Conduct (or arrange to conduct) a baseline IAQ Audit, using I-BEAM audit templates as a guide (see below) and focusing on the fresh air system performance as outlined in the credit criteria, to satisfy the requirements of the credit.
- Conduct (or arrange to conduct) indoor air quality testing of CO and CO_2, to satisfy the requirements of the credit.
- Prepare corrective action plans, where required.

The IAQ Manager signature is required on the IAQ Management Plan confirming appointment and accepting these responsibilities.

EB-IEQ-1 Indoor Air Quality

POINTS AVAILABLE **5**

IAQ MANAGEMENT PLAN

The IAQ Management Plan shall be prepared by the IAQ Manager.

The US EPA I-BEAM Guidelines can be used as a basis for developing the IAQ Management Plan. See:

- http://www.epa.gov/iaq/largebldgs/i-beam/pdfs/text_modules_managing.pdf
- IAQ Program Oversight (PDF)

As a minimum, the following items (main bullets) should be covered in the IAQ Management plan. The sub-bullets are recommended sub-headings.

- **Assignment, Responsibilities and Training**
  - Assign an IAQ Manager (indicate responsibilities as above)
  - Train Supervisors and Staff
- **Establishing an Adequate IAQ Baseline**
  - Update Building Records Important to an IAQ Management Program
  - Conduct a Baseline Building Audit to Determine IAQ Status in the Building
  - Fix Problems Identified in Building Audit (Special IAQ)
- **Written Plans and Protocols**
  - Source Management Protocols (e.g. fit out, painting, pest control and smoking policies)
  - Written Maintenance and Housekeeping Plans
- **Communications Program**
  - Procedure for notifying occupants of major activities affecting IAQ
  - Procedure for receiving and responding to IAQ Complaints
- **Quality Assurance and Inspections**
  - Procedures for inspecting and reviewing implementation of IAQ management plan.

EB-IEQ-1 Indoor Air Quality

POINTS AVAILABLE **5**

SYSTEM PERFORMANCE (MECHANICAL VENTILATION SYSTEMS)

The IAQ Manager shall conduct an audit, or arrange with a suitably experienced (min 5 years HVAC experience) service provider to conduct an audit of the fresh air system. The outcome of the audit shall be an audit report containing the following sections as a minimum. The submission template contains a checklist for these items to make it easier to report on.

- Confirmation that all the fresh air inlets have suitable filters that are in good condition and maintained, therefore ensuring that no dust is being infiltrated though the fresh air inlets.
- Confirmation that the fresh air inlets are suitably positioned away (more than 10m) from outdoor pollutant sources, such as vehicle exhaust, emergency generator exhaust, refuse/waste store, cooling tower etc.
- Confirmation that the regularly occupied spaces are maintained under positive pressure to minimise dust infiltration through the external envelope. This section is best reported on through an air balance calculation. This calculation should be done for each building or floor or air-conditioning zone depending on the building configuration in order to ensure a logical true reflection of the air balance. The calculation should be done through determining the total mechanical fresh air supply to the building (or floor) and comparing it to the total exhaust air extracted from the building (or same floor). If the total mechanical supply air is at least 10% more than the total mechanical exhaust air, then it is assumed that the indoor spaces are under a sufficient net positive pressure to minimise dust infiltration through the external envelope of the building.
- Confirmation that the fresh air distribution system is sufficiently supplying fresh air to all occupied spaces. This will include the confirmation that the fan and ducting arrangement is such that the fresh air will reach all occupied spaces, as well as checking and confirming that the fan system is working and operational during occupied hours.
- If any of the items above are identified as not suitable for any of the spaces, the report shall also include a schedule of corrective actions required, complete with planned implementation dates.

SYSTEM PERFORMANCE (NATURALLY VENTILATION SYSTEMS)

- The IAQ Manager shall provide confirmation that the naturally ventilated spaces have sufficient openable windows as per the requirements of SANS 10400-O for naturally ventilated spaces.

EB-IEQ-1 Indoor Air Quality

POINTS AVAILABLE **5**

INDOOR AIR QUALITY TESTING

The IAQ Manager shall conduct annual indoor air quality testing, or arrange with a suitably qualified service provider to conduct indoor air quality testing using a calibrated device. The outcome of the testing shall be completed in the submission template containing the following sections.

- CO measurements in undercover parking garages.
    - Confirmation that one measurement was taken at least every 1000m^2, and each level of the car park or enclosed area of the car park
    - Confirmation that the measurements were taken 1 meter off the ground,
    - Confirmation that the measurements were taken in locations representative of the car park condition.
    - Total number of measurements taken
    - Total number of measurements below the limit
    - Indicate the percentage of the measurements below the limit.
- CO_2 measurements in all regularly occupied spaces.
    - Confirmation that one measurement was taken in open plan office areas on a grid for at least every 25 people (seats), or in each enclosed space, whichever is smaller.
    - Confirmation that the measurements were taken 1 meter off the ground. ..
    - Confirmation that the measurements were taken in locations representative of the occupied space condition.
    - Total number of measurements taken.
    - Total number of measurements below the limit.
    - Indicate the percentage of the measurements below the limit.
- Provide a schedule of corrective actions complete with implementation dates where 70% or less of the measurements satisfy the minimum ppm requirements.

ADDITIONAL GUIDANCE / RESOURCES

PERFORMANCE PERIOD

- The fresh air system audit and indoor air measurements shall be performed during the 12 month performance period.
- It is recommended that the air quality measurements take place at the same time as the measurements for temperature, humidity, air speed and lighting levels as required by the other IEQ credits.

MIXED MODE

- Buildings in mild climates, without a central HVAC plant and open-able windows can consider managing the HVAC system in mixed mode. This will allow for energy savings while maintaining good indoor air quality.

- It is recommended to effectively communicate this plan with the occupants in order to ensure proper use of the mixed mode approach.
- During mild months/days, the occupants can be informed that the HVAC units will be kept off and that the windows will be opened to allow sufficient cross ventilation.
- It is recommended that a person is assigned with this task (it could be the IAQ manager) to monitor the outdoor temperature, communicate this to the occupants, ensure the windows are opened and closed appropriately and the HVAC systems and mechanical ventilation systems are switched on/off at the correct time.

REGULARLY OCCUPIED SPACES

Regularly occupied spaces shall be defined for the purpose of this credit as all spaces where a person is expected to work, or remain for an extended period of time, including, but not limited to:

- Offices, either open plan or individual;
- Classrooms, lecture halls, theatres, auditoriums and court rooms;
- Computer labs;
- Commercial kitchens and preparation areas where food is sold;
- Retail / sales floor, exhibition halls, multi-purpose rooms, common areas in retail and exhibition buildings.
- Industrial spaces, warehouse areas, shop floors, workstations;
- Hospital wards, procedure rooms, waiting areas

Typical areas that are not regularly occupied are

- Store rooms
- Laundry
- Cloak room
- Display area
- Plant room
- Ablutions
- Tea kitchen

THE ASPECTS THAT AFFECT INDOOR AIR QUALITY ARE:

- Building design
- Physical layout
- Mechanical systems (HVAC)
    - How does air get in?
    - Is it filtered?
    - How does it circulate?
- Equipment and space usage
- Maintenance such as regular cleaning of filters, repairing of leaks etc.
- Control of pollutants generated from fit out and consumables (VOC off-gassing)

Various outdoor pollutant sources to consider when assessing the position of the fresh air inlets are

- building stack exhaust
- vehicle emissions
- industrial processes

- construction activity
- emergency generator exhaust

In order to manage indoor air quality it is important to look at both the source of the pollutant and the pathway to the occupied space. Therefore the following solutions can be considered.

- Barriers between source and occupied space or pressure differentials
- Dilution through extra ventilation
- Increased filtration
- IAQ Management plan

Actions that positively affects the level of particulates

- Good housekeeping
- Upgrade filters
- Maintain positive pressure relative to outdoor areas
- Have proper exhaust design
- Minimize the use of VOC containing products and consumables in the occupied spaces.

Also refer to the following websites and documents for guidelines:

Please note that websites are updated continually. The content as indicated here for certain documents may change and therefore not be exactly as shown.

- CIBSE AM10 Application manual: natural ventilation.
- US Environmental Protection Agency (EPA)
    a. Indoor Air Quality:
    b. http://www.epa.gov/iaq/
    c. IAQ Building Education and Assessment Model (I-BEAM)

    http://www.epa.gov/iaq/largebldgs/i-beam/index.html

    d. I-BEAM Forms

    http://www.epa.gov/iaq/largebldgs/i-beam/forms.html .

    A. Baseline IAQ Audit Forms

    1. Baseline Audit – Indoor Spaces (PDF) (3 pp., 17 K, about PDF) RTF Version (4 pp., 66 K)
    2. Baseline Audit – HVAC System (PDF) (24 pp., 106 K) RTF Version (24 pp., 701 K)
    3. Baseline Audit – Exterior (PDF) (1 page, 10 K) RTF Version (1 page, 49 K)

    B. IAQ Operations and Maintenance Forms

    1. General Information (PDF) (1 page, 7 K) RTF Version (1 page, 39 K)
    2. Periodic Inspections (PDF) (13 pp., 52 K) RTF Version (1 page, 368 K)

C. IAQ Management Forms

1. IAQ Program Oversight (PDF) (4 pp., 16 K) RTF Version (1 page, 109 K)
2. Manager's Indoor Space Inspection (PDF) (PDF, 1 page, 10KB) RTF Version (1 page, 51 K)
3. Manager's AHU Inspection (PDF) (1 page, 10 K) RTF Version (1 page, 73 K)
4. Manager's Air Distribution Inspection (PDF) (1 page, 11 K) RTF Version (1 page, 75 K)
5. Manager's Central Plant Inspection (PDF) (2 pp., 9 K) RTF Version (1 page, 62 K)

D. Occupant Complaint Forms

1. IAQ Complaint Log (PDF) (1 page, 7 K) RTF Version (1 page, 58 K)
2. IAQ Complaint Form (PDF) (1 page, 5 K) RTF Version (1 page, 8 K)
3. IAQ Complaint Interview Form (PDF) (2 pp., 8 K) RTF Version (1 page, 37 K)
4. IAQ Occupant Diary (PDF) (2 pp., 10 K) RTF Version (1 page, 89 K)
5. IAQ Complaint Summary (PDF) (1 page, 5 K) RTF Version (1 page, 41 K

- http://www.who.int/indoorair/en/
- http://www.iaqa.org/

BACKGROUND

Since people working in buildings spend a significant amount of time indoors, it is essential that the quality of the indoor air is sufficient to maintain a healthy and productive environment. With more and more technological advances, new pollutant sources arise all the time and these needs to be addressed by ensuring that the indoor air quality is maintained. This credit focus on the ventilation systems and operational practices in a building to ensure that the system allow a sufficient quantity of fresh air as well as avoids any unnecessary ingress and/or generation of pollutants.

REFERENCES

- South African National Standards, Building Regulations, SANS 10400-O:2011, https://www.sabs.co.za/Standard-Sales/
- ASHRAE 62-2001, Ventilation of acceptable indoor air quality, https://www.ashrae.org/standards-research--technology/standards-interpretations/interpretations-for-standard-62-2001
- Green Star South Africa, Public 7 Education Building v1, https://www.gbcsa.org.za/knowledge/publications/?cat=98

- LEED EBOM, 2009 Edition, http://www.usgbc.org/resources/leed-ebom-2009-reference-guide-supplement-europe-acps-global-acp
- CIBSE AM10, Natural ventilation in non-domestic buildings, http://www.cibse.org/knowledge/cibse-am/am10-natural-ventilation-in-non-domestic-buildings
- EPA Indoor Air Quality Building Education and Assessment Model (I-BEAM), EPA Reference Number 402-C-01-001, December 2002, http://www.epa.gov/iaq/largebldgs/i-beam/overview.html
- Green Star Australia, Green Star Performance, https://www.gbca.org.au/green-star/green-star-performance/

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

EB-IEQ-2 Lighting Comfort

POINTS AVAILABLE **2**

AIM OF CREDIT

To recognize operational practices that provide occupants with a high degree of lighting comfort by addressing discomfort caused by lighting flicker as well as excessive lighting levels

CREDIT CRITERIA

Luminaire ballasts	1 point is awarded where high frequency electronic ballasts are employed in 95% of all fluorescent luminaires in regular occupied spaces. OR A Magnetic Ballast Replacement Program is in place and being implemented.
Lighting comfort	0.5 points are awarded where a process has been undertaken during the performance period to monitor and measure lighting lux levels. An additional 0.5 points are awarded if the maximum maintained illuminance level of no more than 80% of the levels prescribed in SANS 10114-1:2005 is achieved for regularly occupied spaces during the performance period in accordance with this credit. At least 60% of the readings taken must comply with the criteria above to achieve the additional 0.5 points. **This point applies to workstation areas only. For Retail Centres and other building types with minimal workstation areas, this point may be claimed as 'not applicable' where workstation areas and office areas account for less than 10% of the GLA.**
Areas Not Under The Control Of Building Management	The criteria set out within this credit applies to the lighting installations that are specified by and under the control of the building management team (as set out within the lease agreement). AND For lighting installations that are not specified by and under the control of the building management team, a tenant guideline document* must be issued which details the following: • Recommendations for installing high-frequency ballasts in workstation areas • Recommendations for lighting levels in line with the credit criteria in order to address eye-strain in workstation areas. **Note that projects may choose to include the required tenant guidelines in the Building User Guide as per Man-3 Building Management."*

EB-IEQ-2 Lighting Comfort

POINTS AVAILABLE **2**

LUMINAIRE BALLASTS

1 point is awarded if high frequency electronic ballasts are employed in 95% of all fluorescent luminaires in regular occupied spaces.

This credit recognises that not all existing buildings are equipped with modern ballasts, thus buildings not complying with the above requirement can still be eligible for points if a magnetic ballast replacement program, as outlined below, is in place and being implemented.

Fluorescent ballast audit

In confirming that high frequency electronic ballasts are employed in 95% of all fluorescent luminaires in regular occupied spaces, a visual audit must be undertaken by a suitably qualified lighting technician. This person can be part of the in-house facilities team or an external party. The audit must confirm the following:

- Number of fluorescent light fittings
- Percentage of fluorescent fittings that make use of Magnetic Ballasts

The ballast audit report must be signed off by the lighting technician and Facilities Manager.

MAGNETIC BALLAST REPLACEMENT PROGRAM

A magnetic ballast replacement program and contract must be in place during the performance period to replace all the magnetic ballasts in the building within one (1) year. The start to finish duration of the replacement program must not exceed one (1) year to qualify for points in this credit. The replacement program must start within the performance period.

Details of the program must include:

- Replacement product details, and
- Project milestone dates

The program must be signed-off by both the Landlord representative and person responsible for implementing the project.

Details must include whether the program intends to replace ballasts within Tenant premises.

LIGHTING COMFORT

0.5 points are awarded if luminaire performance and general luminance within regularly occupied primary spaces in the building is monitored and verified during the performance period.

Regularly occupied areas where employees are expected to work or remain for an extended period of time may include, but not be limited to:

- Offices, either open plan or private;
- Classrooms, staff offices, computer labs;
- Any areas containing workstations.

A space or area may be excluded from the requirements of this credit, if the use of the space justifies specific lighting conditions that may not be covered by a recognised standard.

LUX PERFORMANCE LEVELS

To achieve the lux performance levels of this creditThe lighting installation shall achieve no more than 80% of the illuminance levels prescribed in SANS 10114-1:2005 (but not lower than the legislative level prescribed by the OHS Act).

For a comprehensive list of minimum maintained illuminance values the reader is directed to Table 1 in SANS 10114-1:2005

Example.

Table 1 *(continued)*

1	2	3	4	5	6
Type of interior, area, task, or activity	**E_m, min. lx**	**UGR, max.**	**R_a, min.**	**Remarks**	**SA legislation min. lx**
Offices (concluded)					
Conference rooms, general offices, typing and filing	500	19	80		300

Table 1. Example - Minimum maintained illuminance, table courtesy of (1)

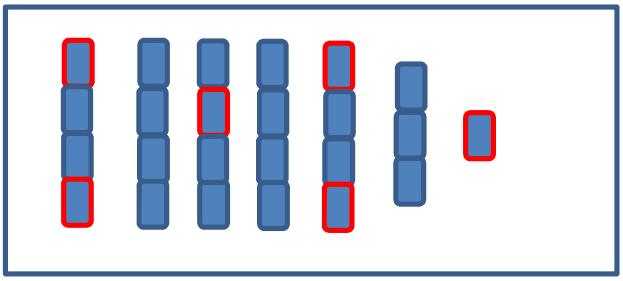
From the table above the minimum lux levels in general office areas must be equal to 500 lux or minimum 300 lux as required by the OHS Act. Thus to achieve the performance parameters, the illumination level at any point may be no more than 400 lux (80%) but cannot be lower than 300 lux (OHS Act lux level)

MEASURING PROCEDURE

Lux levels shall be recorded at work surface height (700mm above finished floor level, horizontally midway between fittings) and the corresponding measurements indicated on floor plans or measurement tables. Where abnormally high or low point readings are obtained; an average of 4 readings on a 1m x 1m grid around the workstation can be used.

For office areas, conference rooms, classrooms or any area with workstations, measurements shall be taken at 25% (rounded up) of the work stations evenly distributed throughout the area. The measurement shall be taken with the lux meter pointing vertically on the workstation. For example if you had a classroom with 23 desks you would need to take six measurements at six evenly distributed desks representing every area of the room:

23 x 25% = 5.75, therefore rounded up to 6 sample readings needed. The example below shows red blocks as readings.



Example: Sample lux measurements on workstations

For areas where there are no demarcated desks, a 10m x 10m grid approach could be used.

Measurements need to be performed with the blinds closed.

All readings to be indicated on a floor plan showing workstation layouts or tabulated and accompanied by a confirmation from the auditor that the above methodology has been employed.

The measurement data shall be signed by person conducting the readings and counter signed by the building owners' Facilities Management Representative based on a representative verified sample to ensure the validity of the data.

DOCUMENTATION REQUIREMENTS / EVIDENCE

Submit all evidence and ensure it readily confirms compliance; also complete online submission template/check list. The following documentation/ evidence are required for this credit:

Criteria	Documentation
All	• **Completed Submission Template** Complete the submission template and append the following documents as prompted within the template.
Luminaire ballasts	For 1 point upload copy of: • **Fluorescent ballast audit report:** ○ Either the submission template is to be signed off by the Lighting Technician and Facility Management representative OR a brief report is required signed off by the Lighting Technician and Facilities Management representative confirming the amount of fluorescent light fittings within the building and the percentage of these which have magnetic ballasts OR • **Magnetic ballast replacement program contract** Signed off by the Landlord representative and person responsible for implementing the project. Detailing: ○ Replacement products (are they high frequency ballasts) ○ Timelines for replacement program (within 12 months)
	For 0.5 points upload copy of:

EB-IEQ-2 Lighting Comfort

POINTS AVAILABLE **2**

Lighting comfort	• **Lighting Comfort Report** detailing: o List of all areas audited in the building o Confirmation that all regularly occupied spaces with workstation areas were tested o Number of readings taken (and % of readings compliant if additional o.5 points are targeted) o A representative sample of the readings (min 10 spaces) with Lux level readings recorded on floor plans showing workstation layouts OR tabulated lux level readings o Description of measuring equipment used plus copy of valid calibration certificate o Date and time measurements were taken o Party responsible for taking the measurements, including position & role, and sign-off from this party o Counter signed by the building owners' Facility Management representative or suitable owner representative (if testing not done in-house) For an additional 0.5 points, the above report must clearly indicate what percentage of the readings taken comply with the credit criteria (no more than 80% of SANS 10114-1:2005 and above OHS Act lux levels)
Areas not under Building Management Control	• **Tenant Guidelines** Copy of issued guidelines detailing: o Recommendations for installing high-frequency ballasts in workstation areas • Recommendations for lighting levels in line with the credit criteria in order to address eye-strain in workstation areas.

ADDITIONAL GUIDANCE / RESOURCES

Lighting comfort parameters

The focus of this credit is on measuring and maintaining appropriate lux levels in regularly occupied areas of the building.

Although not formally recognised by this credit the following parameters also play a key role in lighting comfort:

- Colour Rendering Index (CRI)
- Colour temperature
- Glare

Additional guidance with regards to CRI, colour temperature and glare control can be found in SANS 10114-1. The standard also provides minimum maintained illuminance values, as well as lux levels, CRI and colour temperature for standard interior spaces. In addition to the SANS recommended levels, the Occupational Health and Safety Act lux level requirements are also provided. It should be noted that the OHS Act levels are legislative and must be achieved to comply with legislation.

The table below is an extract from SANS-10114-1 which provides guidance on lux levels for general building areas. For a comprehensive list of interior, area, task and activities, the reader is directed to the SANS document.

1	2	3	4	5	6
Type of interior, area, task, or activity	**E_m, min.** lx	**UGR, max.**	**R_a, min.**	**Remarks**	**SA legislation min.** lx
General building areas					
Entrance halls	100	22	60		
Lounges	200	22	80		
Circulation areas and corridors	100	28	40		100
Stairs, escalators and travelators	150	25	40		
Loading ramps/bays	150	25	40		
Canteens	200	22	80		
Rest rooms	100	22	80		
Rooms for physical exercise	300	22	80		
Cloakrooms, washrooms, bathrooms, toilets	200	25	80		
Sick bays	500	19	80		
Rooms for medical attention	500	16	90		
Plant rooms, switch-gear rooms	200	25	60		
Post rooms, switchboards	500	19	80		
Stores, stockrooms, cold stores	100	25	60	200 lx if continuously occupied	100
Dispatch packing and handling areas	300	25	60		
Control stations	150	22	60	200 lx if continuously occupied	

Table 2. General Building Area lux levels (1)

Additional guidance on the remaining lighting comfort parameters identified in the section above is provided in the section below. For optimal lighting comfort in the working environment, these parameters should also be aligned with the standards and recommendations. Note that measurement or compliance with these parameters are not required within this credit however.

Colour rending index (CRI)

The following table shall be used to determine colour rendering index of luminaires:

1	2
Type of lamp	**Colour-rendering index/range**
Incandescent	Very good = 100
Tungsten halogen	Very good = 100
Fluorescent	Standard = ± 60 Triphosphor = 80 to 98
Blended	Fair = 60
Metal halide	Good = 80 to 90
Mercury vapour	Standard = ± 46
High-pressure sodium	Standard = 20 (Poor) Deluxe = 65
Low-pressure sodium	Bad = 0
NOTE This information is provided for guidance only. Specific details should be specified by the manufacturer.	

Table 3. Typical lamp colour rendering index (1)

Measuring procedure

To measure the CRI in an area the above table can be used to select the appropriate CRI range depending on the type of lamp used. For example, if an area is lit by tri-phosphor fluorescent lamps, the CRI will be 80-98.

Colour temperature

The following table can be used to determine the colour temperature of luminaires:

Colour appearance	Correlated colour temperature (K)
Warm	< 3 300
Intermediate	3 300 to 5 300
Cold	> 5 300

Table 4. Lamp colour temperature (1)

The table below provides a guide for fluorescent lamps.

Kelvin	Lamp name[1]
3000 K	Warm white
3500 K	White
4000 K	Cool white
5400 K	Daylight
6500 K	Cool daylight

Table 5. Fluorescent lamp colour temperature guide

The following table can be used as a guide to determine colour temperature and CRI suitability:

1	2	3	4	5
Colour-rendering group	**Colour-rendering index range**	**Colour appearance**	**Examples of use**	
			Preferred	**Acceptable**
1A	$R_a \geq 90$	Warm Intermediate Cold	Colour matching Clinical examinations Picture galleries	—
1B	$90 > R_a \geq 80$	Warm Intermediate	Houses, hostels, restaurants, shops, offices, schools, hospitals	
		Intermediate Cold	Printing, paint and textile industries, demanding industrial work	
2	$80 > R_a \geq 60$	Warm Intermediate Cold	Industrial work	Offices, schools
3	$60 > R_a \geq 40$	Cold	Rough industries	Industrial work
4	$40 > R_a \geq 20$	Warm	—	Rough industries, industrial work with low-order colour - rendering requirements
NOTE If so desired, colour-rendering group 2 can be subdivided into groups 2A and 2B in a way that corresponds to the subdivision of group 1.				

Table 6. Lamp colour-rendering suitability chart (1)

[1] Lamp names may vary from manufacture to manufacturer.

Measuring procedure
To determine the colour temperature of lamps, the installed lamps' datasheet or product packages must be studied.

Example:
The colour temperature of a 36W/840 fluorescent tube that is used in an office environment is 4000K

Discomfort glare

Eliminating glare from regularly occupied areas during the performance period can be achieved as described below:

- All *bare lamps* directing light onto task areas are fitted with baffles, louvers, translucent diffusers, or other means that directly obscure the lamp from view when space is under typical operating conditions.
- Daylight glare control measures are in place (fixed shading, occupant controlled/automated blinds/screens

BACKGROUND

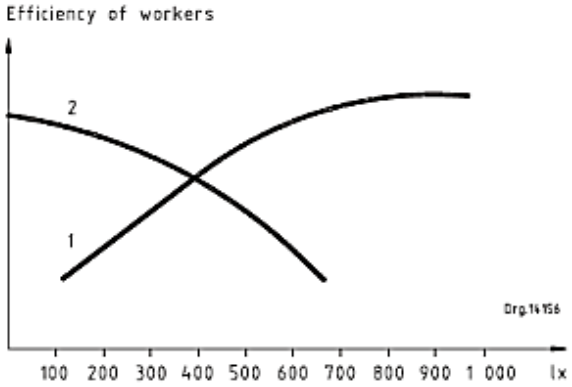
Four key issues to consider with respect to lighting and indoor environment quality are:

- The potential impacts from light flickering
- The impacts from poor reproduction of colours
- Eye strain from excessive electric lighting levels, and
- Glare from exposed lamps.

Flickering in lights can lead to headaches, eye strain and general eye discomfort. Solutions include removing the causes of flickering by utilizing electronic instead of magnetic ballasts, or installing solid state lights.

Poor colour rendering usually results in badly lit spaces. Using the right colour rendering for the right activity will result in improved lighting comfort.

Electric lighting levels, especially the SANS 10114 lighting levels are often quite high in comparison to international best practice, especially in modern computer based work areas. The corresponding lighting levels provided in the OHS Act can be used as these are generally lower than the levels stated in SANS. In addition, the graph below extracted from SANS 10114 illustrates the effect of lux levels and the use of visual display units (VDU) on the efficiency of workers.



1 – Normal office work
2 – VDU work

This document recognises that modern building occupants use computers with modern screens making lower levels comfortable. Lighting levels of 300 lux for purely screen based work is acceptable.

REFERENCES

1. **South African National Standard.** *Interior lighting Part 1: Artificial lighting of interiors.* Pretoria : SABS Standards Division, 2005. SANS 10114-1:2005.
2. **RSA Department of Labour.** *Occupational Health and Safety Act.* Pretoria : Government, 1993. Act No. 85 of 1993 (OHS Act).
3. **Green Star Australia.** Green Star - Performance . Sydney : s.n., 2013.

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

EB-IEQ-3 Thermal Comfort

POINTS AVAILABLE **2**

AIM OF CREDIT

To recognize operational practices that monitor and maintain a high level of thermal comfort for building occupants.

CREDIT CRITERIA

Mechanically or Naturally Ventilated Spaces	1 point is awarded where there is a process implemented to • Measure temperature in occupied spaces at least once in the summer and once in the winter. 1 point is awarded where there is a process implemented to • Assess via a high-level walk-through audit, any concerns related to radiant heat or draft* (air speed) in occupied spaces. • Gather occupant feedback through a thermal comfort survey feedback form. **Mechanically ventilated spaces only*.
Areas Not Under The Control Of Building Management:	**Note the following applicable for areas that are not under the control of the building management:** The criteria set out within this credit applies to the HVAC installations that are specified by and under the control of the building management team (as set out within the lease agreement). For HVAC installations that are not specified by and under the control of the building management team, a tenant guideline document* must be issued which details the following: • Recommendations for measurement and control of temperature in the occupied spaces • Recommendations for conducting occupant comfort surveys with respect to thermal comfort **Note that projects may choose to include the required tenant guidelines in the Building User Guide as per Man-3 Building Management."*

EB-IEQ-3 Thermal Comfort

POINTS AVAILABLE **2**

DOCUMENTATION REQUIREMENTS

Criteria	Documentation
Temperature Measurement:	• **Completed Submission Template** • **Sample of Temperature Readings** (min 10 spaces)
High-Level Audit & Occupant Feedback	• **Completed Submission Template** • **Schedule of Radiant Heat & Air Speed Problem Areas** • **Sample Thermal Comfort Questionnaire**
Areas Not Under Landlord Control	• **Completed Submission Template** • **Tenant Guideline Document**

THERMAL COMFORT TESTING

The IAQ Manager shall conduct indoor thermal comfort testing, or arrange with a suitably experienced service provider to conduct indoor thermal comfort testing using a calibrated, handheld portable device. The outcome of the testing shall be confirmed in the submission template as follows.

For 1st Point:

- Confirmation that one temperature measurement was taken in open plan areas on a grid for at least
    - Every 25 people (or seats), or in each enclosed space (whichever is smaller), and
    - In positions representative of the average temperature for that space.
- Confirmation that the measurements were taken between 1m and 1.8m off the ground.
- Confirmation that the Temperature measurements were taken at least once during the summer (December to February) and at least once during the winter (June to August).
- Confirmation that the measurements were taken during normal occupied hours.

For 2nd Point:

- Confirmation that the radiant heat was assessed on the eastern façade in the morning and the western façade in the afternoon, with schedule of identified problem areas. Confirmation that issues relating to draft or excessive air speed (mechanically ventilated spaces) have been highlighted and a schedule of problem areas produced.
- Sample of occupant thermal comfort survey questionnaire should be provided.

OCCUPANT THERMAL ENVIRONMENT SURVEY

- All occupants shall be requested to complete a thermal environment survey (an example of a standard survey template is ASHRAE 55-2004 shown in Appendix E as well as a simplified alternative that can be incorporated into the occupant survey as per the IEQ-4 credit).
- A minimum response rate shall be required as detailed within the IEQ-4 Occupant Survey credit.

- A minimum of one occupant survey shall be done during the performance period and it may be included as part of the general occupant survey performed under IEQ-4.

REGULARLY OCCUPIED SPACES

Regularly occupied spaces shall be defined for the purpose of this credit as all spaces where a person is expected to work, or remain for an extended period of time, including, but not limited to:

- Offices, either open plan or individual;
- Classrooms, lecture halls, theatres, auditoriums and court rooms;
- Computer labs;
- Commercial kitchens and preparation areas where food is sold;
- Retail / sales floor, exhibition halls, multi-purpose rooms, common areas in retail and exhibition buildings.
- Industrial spaces, warehouse areas, shop floors, workstations;
- Hospital wards, procedure rooms, waiting areas

EXTENT OF OCCUPIED SPACE MEASUREMENT

- Single tenant building: In order to achieve full points, 80% of GLA is measured and assessed in order to maintain the respective comfort conditions.
- Multi tenant building: In order to achieve full points, 70% of GLA is measured and assessed in order to maintain the respective comfort conditions.
- In the event of a multi storey (or multi unit) building where a number of floors (or units) are identical in terms of size, orientation, layout, use and operation, then a sample of 25% of the floors (or units) measured will be sufficient. For example for a 6 storey building where the ground floor is unique but the 1st to 5th storeys are identical, then measurements of ground, first and fifth storey will be required. The upper level is typically different due to the heat load from the roof. The measurements of the 1st storey is sufficient (25%) of the four storeys.

ADDITIONAL GUIDANCE / RESOURCES

Performance Period
Performance period relates to the continuous time period during which a credit is measured or data is collected. For the Thermal Comfort credit, the performance period is the most recent 12 month period of operations preceding the submission for certification that includes at least one summer month and one winter month.

INFORMATIVE APPENDIX E— THERMAL ENVIRONMENT SURVEY

THERMAL ENVIRONMENT SURVEY	Survey Number:
WHITE SECTIONS TO BE FILLED IN BY OCCUPANT	Surveyor's Name:
1. Occupant's Name:	**11. Occupant Location in Area** (Place an "X" in the approximate place where you most often work.) 
2. Date:	
3. Time:	
4. Approx. Outside Air Temperature (°F or °C):	
5. Sky: ❑ Clear ❑ Mixed (Sun & Clouds) ❑ Overcast	
6. Seasonal Conditions ❑ Winter ❑ Spring ❑ Summer ❑ Fall	
7. Occupant's Clothing Please refer to the attached Table 1. Place a check mark next to the articles of clothing that you are currently wearing as you fill out this sheet. If you are wearing articles of clothing not listed in the table, please enter them into the space provided below. Article:	**SURVEYOR'S USE ONLY** Clothing Insulation Summary: Total I_{cl} = _____ clo
Article:	
8. Occupant Activity Level (Check the one that is most appropriate) 1. ❑ Reclining 2. ❑ Seated Quite 3. ❑ Office, school 4. ❑ Standing Relaxed 5. ❑ Light Activity Standing 6. ❑ Medium Activity, Standing 7. ❑ High Activity	**Metabolic Rates (met)** 1. 0.8 met 2. 1.0 met 3. 1.2 met 4. 1.2 met 5. 1.6 met 6. 2.0 met 7. 3.0 met
9. Equipment (Equipment adding or taking away from the heat load.)	
Item (computers, copiers, lighting, fans, etc.) / **Quantity**	**Total Heat Added/ Subtracted**
10. General Thermal Comfort (Check the one that is most appropriate) 1. ❑ Hot 2. ❑ Warm 3. ❑ Slightly Warm 4. ❑ Neutral 5. ❑ Slightly Cool 6. ❑ Cool 7. ❑ Cold	Thermal Sensation Scale 1. +3 2. +2 3. +1 4. 0 5. –1 6. –2 7. –3
General Environment Comments:	**Area Summary:**
	Room/Building Type:
	Outside Relative Humidity: %
	Thermostat Setting: °F or °C
	Humidity setpoint: %
	Total Number of Occupants:

ASHRAE 55 Thermal Environment Occupant Survey

Alternative Simplified Example Thermal Comfort Survey Questions

- These questions can be incorporated into the normal occupant survey as outlined in IEQ-4
- Date:
- Time:
- Approximate outdoor temperature:
- Current season:
- General Thermal Comfort experienced by occupant

	Currently	Typical morning	Typical afternoon	General Summer	General Winter
Hot					
Warm					
Slightly Warm					
Neutral					
Slightly cool					
Cool					
Cold					

- Any specific items causing discomfort:

INNOVATION CHALLENGE:

In addition to the criteria set out in this credit, the GBCSA encourage project teams to target the following 'Innovation Challenge'. Where the following criteria can be met, project teams may claim this as an Innovation Point under Inn-02 Exceeding Green Star SA Benchmarks'.

Innovation Challenge Criteria:

- Achieve full points under EB-IEQ-3 Thermal Comfort.

For Mechanically Ventilated Spaces:

- Measure air speed at the same time as the temperature measurements above.
- Confirm predicted mean vote (PMV) levels, calculated in accordance with ISO7730 tables E.1 to E.9 (see below) using standard clothing and metabolic rates values, are within the following limits for at least 90% of the measurements during both measurement periods:
    - PMV levels between -1.0 and + 1.0 (inclusive)

For Naturally Ventilated Spaces:

- At least 90% of the measured internal operative temperatures are within the ASHRAE Standard 55-2004 80% Acceptability Limits (see below), OR

- The predicted mean vote (PMV) levels calculated in accordance with ISO7730 tables E.1 to E.9 (see below)using standard clothing and metabolic rate values, are within the following limits for at least 90% of the measurements during both measurement periods:
    - PMV levels between -1.0 and + 1.0 (inclusive)

Documentation Requirements:

PMV Calculations	**Short Report containing:** • **Summary of PMV calculations** • **Table of measurements taken for typical spaces**
ASHRAE Calculations	**Short Report containing:** • **Summary of ASHRAE 55 Calculations**

Short Report must provide:

- Confirmation that the assessor noted down the occupants activity and clothing levels at the time of taking the measurements. General activity and clothing level for a building / space can be used for the PMV calculation. It is not necessary to consider each individual separately.
- Total number of measurements taken.
- Total number of measurements below the limit.
- Indicate the percentage of the measurements below the limit.
- PMV Summary Result using collected data (temperatures, air speed, clothing levels and activity level) ISO 7730 tables E.1 to E.9. The PMV results shall indicate the total percentage of PMV values within the range of -1.0 to +1.0.
- ASHRAE 55 acceptability results. If the space is naturally ventilated then using only the monthly average outside temperature and the measured indoor temperature, determine if the measurement is within or out of the 80% acceptability range according to ASHRAE 55 figure 5.3. Alternatively the PMV results as indicated above can be used for naturally ventilated spaces.

Below are example PMV values using ISO 7730 Tables E.1 to E.9 with 80% satisfaction rates highlighted for typical office activity levels and standard winter and summer clothing. Table E.3 relates to individuals with a metabolic rate of 1.2 (office work).

(PMV Values between -1.0 and +1.0)

EB-IEQ-3 Thermal Comfort

POINTS AVAILABLE **2**

Table E.3 — Activity level: 69,6 W/m² (1,2 met)

Clothing		Operative temperature	Relative air velocity							
			m/s							
clo	m² · K/W	°C	<0,10	0,10	0,15	0,20	0,30	0,40	0,50	1,00
0	0	25	−1,33	−1,33	−1,59	−1,92				
		26	−0,83	−0,83	−1,11	−1,40				
		27	−0,33	−0,33	−0,63	−0,88				
		28	0,15	0,12	−0,14	−0,36				
		29	0,63	0,56	0,35	0,17				
		30	1,10	1,01	0,84	0,69				
		31	1,57	1,47	1,34	1,24				
		32	2,03	1,93	1,85	1,78				
0,25	0,039	23	−1,18	−1,18	−1,39	−1,61	−1,97	−2,25		
		24	−0,79	−0,79	−1,02	−1,22	−1,54	−1,80	−2,01	
		25	−0,42	−0,42	−0,64	−0,83	−1,11	−1,34	−1,54	−2,21
		26	−0,04	−0,07	−0,27	−0,43	−0,68	−0,89	−1,06	−1,65
		27	0,33	0,29	0,11	−0,03	−0,25	−0,43	−0,58	−1,09
		28	0,71	0,64	0,49	0,37	0,18	0,03	−0,10	−0,54
		29	1,07	0,99	0,87	0,77	0,61	0,49	0,39	0,03
		30	1,43	1,35	1,25	1,17	1,05	0,95	0,87	0,58
0,50	0,078	18	−2,01	−2,01	−2,17	−2,38	−2,70			
		20	−1,41	−1,41	−1,58	−1,76	−2,04	−2,25	−2,42	
		22	−0,79	−0,79	−0,97	−1,13	−1,36	−1,54	−1,69	−2,17
		24	−0,17	−0,20	−0,36	−0,48	−0,68	−0,83	−0,96	−1,35
		26	0,44	0,39	0,26	0,16	−0,01	−0,11	−0,21	−0,52
		28	1,05	0,98	0,88	0,81	0,70	0,61	0,54	−0,31
		30	1,64	1,57	1,51	1,46	1,39	1,33	1,29	1,14
		32	2,25	2,20	2,17	2,15	2,11	2,09	2,07	1,99
0,75	0,116	16	−1,77	−1,77	−1,91	−2,07	−2,31	−2,49		
		18	−1,27	−1,27	−1,42	−1,56	−1,77	−1,93	−2,05	−2,45
		20	−0,77	−0,77	−0,92	−1,04	−1,23	−1,36	−1,47	−1,82
		22	−0,25	−0,27	−0,40	−0,51	−0,66	−0,78	−0,87	−1,17
		24	0,27	0,23	0,12	0,03	−0,10	−0,19	−0,27	−0,51
		26	0,78	0,73	0,64	0,57	0,47	0,40	0,34	0,14
		28	1,29	1,23	1,17	1,12	1,04	0,99	0,94	0,80
		30	1,80	1,74	1,70	1,67	1,62	1,58	1,55	1,46
1,00	0,155	16	−1,18	−1,18	−1,31	−1,43	−1,59	−1,72	−1,82	−2,12
		18	−0,75	−0,75	−0,88	−0,98	−1,13	−1,24	−1,33	−1,59
		20	−0,32	−0,33	−0,45	−0,54	−0,67	−0,76	−0,83	−1,07
		22	0,13	0,10	0,00	−0,07	−0,18	−0,26	−0,32	−0,52
		24	0,58	0,54	0,46	0,40	0,31	0,24	0,19	0,02
		26	1,03	0,98	0,91	0,86	0,79	0,74	0,70	0,58
		28	1,47	1,42	1,37	1,34	1,28	1,24	1,21	1,12
		30	1,91	1,86	1,83	1,81	1,78	1,75	1,73	1,67

ISO 7730 Example thermal comfort design criteria

Table B.1 — Metabolic rates

Activity	Metabolic rate	
	W/m^2	met
Reclining	46	0,8
Seated, relaxed	58	1,0
Sedentary activity (office, dwelling, school, laboratory)	70	1,2
Standing, light activity (shopping, laboratory, light industry)	93	1,6
Standing, medium activity (shop assistant, domestic work, machine work)	116	2,0
Walking on level ground:		
2 km/h	110	1,9
3 km/h	140	2,4
4 km/h	165	2,8
5 km/h	200	3,4

ISO 7730 Example metabolic rates for activities

Table C.1 — Thermal insulation for typical combinations of garments

Work clothing	I_{cl}		Daily wear clothing	I_{cl}	
	clo	$m^2 \cdot K/W$		clo	$m^2 \cdot K/W$
Underpants, boiler suit, socks, shoes	0,70	0,110	Panties, T-shirt, shorts, light socks, sandals	0,30	0,050
Underpants, shirt, boiler suit, socks, shoes	0,80	0,125	Underpants, shirt with short sleeves, light trousers, light socks, shoes	0,50	0,080
Underpants, shirt, trousers, smock, socks, shoes	0,90	0,140	Panties, petticoat, stockings, dress, shoes	0,70	0,105
Underwear with short sleeves and legs, shirt, trousers, jacket, socks, shoes	1,00	0,155	Underwear, shirt, trousers, socks, shoes	0,70	0,110
Underwear with long legs and sleeves, thermo-jacket, socks, shoes	1,20	0,185	Panties, shirt, trousers, jacket, socks, shoes	1,00	0,155
Underwear with short sleeves and legs, shirt, trousers, jacket, heavy quilted outer jacket and overalls, socks, shoes, cap, gloves	1,40	0,220	Panties, stockings, blouse, long skirt, jacket, shoes	1,10	0,170
Underwear with short sleeves and legs, shirt, trousers, jacket, heavy quilted outer jacket and overalls, socks, shoes	2,00	0,310	Underwear with long sleeves and legs, shirt, trousers, V-neck sweater, jacket, socks, shoes	1,30	0,200
Underwear with long sleeves and legs, thermo-jacket and trousers, Parka with heavy quitting, overalls with heave quilting, socks, shoes, cap, gloves	2,55	0,395	Underwear with short sleeves and legs, shirt, trousers, vest, jacket, coat, socks, shoes	1,50	0,230

ISO 7730 Example clothing levels for typical combinations

Table A.5 — Example design criteria for spaces in various types of building

Type of building/space	Activity W/m²	Category	Operative temperature °C		Maximum mean air velocity [a] m/s	
			Summer (cooling season)	Winter (heating season)	Summer (cooling season)	Winter (heating season)
Single office Landscape office Conference room Auditorium Cafeteria/restaurant Classroom	70	A	24,5 ± 1,0	22,0 ± 1,0	0,12	0,10
		B	24,5 ± 1,5	22,0 ± 2,0	0,19	0,16
		C	24,5 ± 2,5	22,0 ± 3,0	0,24	0,21 [b]
Kindergarten	81	A	23,5 ± 1,0	20,0 ± 1,0	0,11	0,10 [b]
		B	23,5 ± 2,0	22,0 ± 2,5	0,18	0,15 [b]
		C	23,5 ± 2,5	22,0 ± 3,5	0,23	0,19 [b]
Department store	93	A	23,0 ± 1,0	19,0 ± 1,5	0,16	0,13 [b]
		B	23,0 ± 2,0	19,0 ± 3,0	0,20	0,15 [b]
		C	23,0 ± 3,0	19,0 ± 4,0	0,23	0,18 [b]

[a] The maximum mean air velocity is based on a turbulence intensity of 40 % and air temperature equal to the operative temperature according to 6.2 and Figure A.2. A relative humidity of 60 % and 40 % is used for summer and winter, respectively. For both summer and winter a lower temperature in the range is used to determine the maximum mean air velocity.

[b] Below 20 °C limit (see Figure A.2).

ASHRAE 55 Example design criteria for space in various types of buildings.

Naturally Ventilated spaces

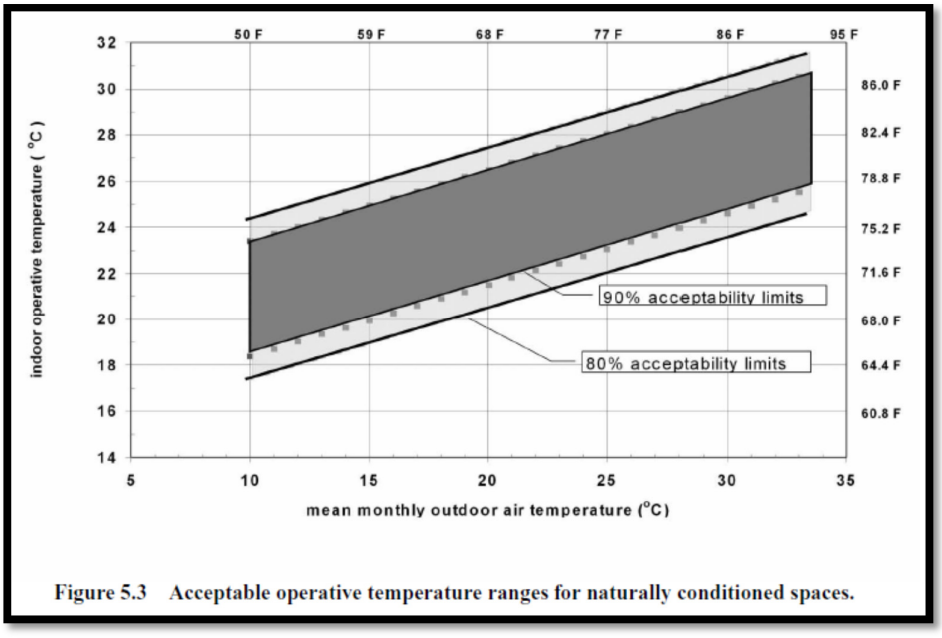


Figure 5.3 Acceptable operative temperature ranges for naturally conditioned spaces.

ASHRAE 55-2004 Acceptability Criteria

ASHRAE 55-2004 Adaptive Comfort Temperatures

The ASHRAE guide defines a range of temperatures which are deemed comfortable for a naturally ventilated space, where occupants have control over openings. These depend on the mean monthly outside air temperature, based on the fact that people living in warmer areas can tolerate higher internal temperatures than those living in cold areas. An approximate summary of the data is as follows:

Mean monthly outdoor temp °C	Min internal temp (80% acceptability) °C	Min internal temp (90% acceptability) °C	Max internal temp (90% acceptability) °C	Max internal temp (80% acceptability) °C
10	17.5	18.5	23.5	24.5
15	19	20	25	26
20	20.5	21.5	26.5	27.5
25	22	23	28	29
30	23.5	24.5	29.5	30.5

Table IEQ-9.1: *Adaptive Comfort Temperatures as defined in ASHRAE 55-2004*

These internal temperatures are 'operative' internal temperatures, defined in ASHRAE Fundamentals 2001. For occupants not sitting in direct sunlight, this can be approximated as the mean of the air temperature and the mean radiant temperature.

ASHRAE 55-2004 Adaptive Comfort Temperatures

BACKGROUND

Thermal comfort is important for the occupants of a building to remain productive if they spend a significant amount of time in the space. The perception of thermal comfort is influenced through a variety of factors such as clothing, activity level, air and radiant temperature, relative humidity and air speed.

The first step in maintaining thermal comfort conditions are to have a process in place to monitor the major factors that influence thermal comfort such a temperature humidity and air speed.

In order to ultimately determine if thermal comfort levels are achieved these measured values together with the activity and clothing levels are required to be used in a predicted mean vote (PMV) calculation in order to determine if the majority of the occupants will experience comfort levels.

This credit aims at using occupant surveys and a simplified calculation methodology to determine if the thermal comfort is achieved in the building.

EB-IEQ-3 Thermal Comfort

POINTS AVAILABLE **2**

REFERENCES

- ISO7730 – PMV Levels (Predicted Mean Vote), http://www.iso.org/iso/catalogue_detail.htm?csnumber=39155 ASHRAE 55-2004 (and 2010),
- https://www.ashrae.org/resources--publications/bookstore/standard-55
- Green Star South Africa, Public & Education Building v1Rating tool, https://www.gbcsa.org.za/knowledge/publications/?cat=98
- LEED EBO&M, 2009 Edition, http://www.usgbc.org/resources/leed-ebom-2009-reference-guide-supplement-europe-acps-global-acp
- Green Star Australia, Green Star Performance, https://www.gbca.org.au/green-star/green-star-performance/

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

EB-IEQ-4 Occupant Comfort Survey

POINTS AVAILABLE 2

AIM OF CREDIT

To encourage the assessment of building occupants' satisfaction as it relates to comfort

CREDIT CRITERIA

Occupant Survey	1 point is awarded where at least one occupant comfort survey is conducted during the performance period.
Occupant Satisfaction Levels	Points will be awarded for a survey outcome during the performance period, according to the table below:

Survey Outcome	Points to be awarded
At least 80% of respondents indicate on average that they are 'Satisfied' (above neutral on the chosen scale)	1
At least 60% of respondents indicate they are 'Satisfied' above neutral on the chosen scale)	0.5

OR

0.5 points are awarded where performance improvement of 5% or more is achieved from the previous survey.

OR

0.5 points are awarded where a corrective action plan is in place to improve performance.

At least one survey must be undertaken during the measurement period, in order to obtain points under this credit.

A. Occupant Survey

Survey Compliance Checklist

Question	Yes	No
Does the survey have a suitable rating scale to evaluate the 'Satisfaction' levels of occupants? (7-point scale is recommended)	□	□
Is the survey configured such that all 'Survey Categories' as detailed in this credit are represented?	□	□
If a corrective action plan has been submitted, does it comply with the 'Corrective Action Plan Criteria'?	□	□

Survey Categories

EB-IEQ-4 Occupant Comfort Survey

POINTS AVAILABLE 2

In order for an occupant survey to be deemed compliant, the following survey categories need to be included:

- Acoustic comfort
- Thermal comfort
- Lighting
- Indoor air quality and ventilation
- Building management (cleanliness, odours, etc.)

Population

For all population calculations, the number of regular occupants should be the maximum number of occupants that will regularly work at the premises* (Full Time Equivalent (FTE) employees) during the performance period. Population sizes can be estimated where there is no access to more precise figures, by using typical occupancy per square meter.

Note – for buildings with multiple uses, the required survey population sizes must be met for each distinct use. E.g. for a building with Retail and Office areas, the required sample sizes must be met for both these areas.

Survey Sample Size Determination

Table 2 below summarizes the number of responses needed to create a representative sample size, depending on the number of people in the building. Responses for 5% Margin of Error are given for information, but for the purposes of compliance with this credit, a 10% Margin of Error is acceptable.

Table 2: Determining survey sample size

Survey Responses needed for 95% Confidence		
Population Size	Responses Needed for 5% Margin of Error(Sample Size)	**Responses Needed for 10% Margin of Error(Sample Size)**
>100	75%	**75%**
100	81	**51**
150	110	**61**
200	134	**67**
250	154	**72**
300	172	**76**
350	187	**78**
400	201	**81**
450	212	**82**
500	222	**83**
700	255	**88**
900	277	**90**
1000	286	**91**
2000	333	**95**
5000	370	**98**

10000	385	**99**
20000	392	**100**

Source: Determining Sample Size. http://edis.ifas.ufl.edu/pd006

B. Occupant Satisfaction Levels

Survey Rating Scale Questions

Surveys must utilise a suitable scale for determining the level of 'satisfaction' of occupants. Below is an example of an acceptable scale in this regard.

Table 1: Seven point scale example

Question	**7**	**6**	**5**	**4**	**3**	**2**	**1**
"How satisfied are you with...?"	Very satisfied	Mostly satisfied	Satisfied	Neutral	Dissatisfied	Mostly dissatisfied	Very dissatisfied

Corrective Action Plan

For the additional point to be awarded for the corrective action plan, the following is required:

- A clear list describing problematic or focus areas and services as highlighted in the survey results
- Show action tasks required to address problematic areas
- Allocate responsible resources to each action task
- Set action task start and completion dates

DOCUMENTATION REQUIREMENTS

Submit all the evidence and ensure it readily shows compliance,

Criteria	**Documentation**
All	• **Completed Submission Template**
Occupant Survey	• **Sample of Completed Survey**
Satisfaction Levels	• **Survey Results Summarised in Submission Template** • **Sample of Previous Survey** (where improvement is claimed) • **Corrective Action Plan** (where applicable)

EB-IEQ-4 Occupant Comfort Survey

POINTS AVAILABLE 2

ADDITIONAL GUIDANCE

Survey Questions – Examples

Thermal Comfort

In winter months, how satisfied are you with the temperature in your office?

- Very Satisfied
- Mostly Satisfied
- Satisfied
- Neutral
- Dissatisfied
- Mostly Dissatisfied
- Very Dissatisfied

Acoustic Comfort

How satisfied are you with the noise level in your workspace?

- Very Satisfied
- Mostly Satisfied
- Somewhat Satisfied
- Neutral
- Somewhat Dissatisfied
- Mostly Dissatisfied
- Very Dissatisfied

Lighting

How satisfied are you with the visual comfort of the lighting (e.g., glare, reflections, contrast)?

- Very Satisfied
- Mostly Satisfied
- Somewhat Satisfied
- Neutral
- Somewhat Dissatisfied
- Mostly Dissatisfied
- Very Dissatisfied

Air Quality

How satisfied are you with the air quality in your workspace (i.e. dusty, stuffy/stale air, cleanliness, odors)

- Very Satisfied
- Mostly Satisfied
- Somewhat Satisfied
- Neutral
- Somewhat Dissatisfied
- Mostly Dissatisfied
- Very Dissatisfied

EB-IEQ-4 Occupant Comfort Survey

POINTS AVAILABLE 2

Guidelines for Writing Effective Survey Questions

1) Questions should be linked to research aims and objectives

- Ensure the question provides the information needed to fulfill the research objectives

2) Questions should be kept short and simple so the respondents have the best chance to understand them

- The question should only ask one question.
- The question must be worded appropriately for the target population.
- The question must be clear, precise, and unambiguous.
- The question must be simple to understand.
- Avoid unnecessary adjectives and adverbs.
- Avoid negatives and double negatives.

3) Put the Question in Context

- The wording of the question should not make unwarranted assumptions.
- The wording should follow a natural order from the previous question.

Source: Snap Surveys (Website: www.snapsurveys.com)

BACKGROUND

The occupant satisfaction surveys have been used extensively by building owners and managers to gauge overall building comfort levels and performance of specific building services. Popular subjects to consider when structuring surveys include issues relating to comfort, building user-friendliness, general up-keep, availability and performance of critical building services and systems.

The occupant comfort survey in this document takes into account all occupant comfort elements developed as part of the Green Star SA Existing Building Performance framework.

REFERENCES & FURTHER INFORMATION

Snap Surveys, Website: www.snapsurveys.com

BOSSA – Building Occupants Survey System Australia Version 2 September 2012

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

EB-IEQ-5 Acoustic Quality

POINTS AVAILABLE 3

AIM OF CREDIT

To encourage operational practices that monitor acoustic comfort factors and strive to improve performance to ensure acoustic comfort for building occupants and minimize impact on surrounding buildings.

CREDIT CRITERIA

High-Level Acoustic Audit	1 point is awarded where the Facilities Management team conducts a high-level audit of the building to identify areas of concern. Based on this audit, a corrective action plan must be produced. The Audit must at a minimum consider: 1. Occupant Feedback (conduct survey) 2. Impact of Plant / Equipment Noise on Occupants 3. Impact of Plant / Equipment Noise on Surrounding Properties 4. Impact of External Noise Sources on Occupants 5. Noise Transference Between Tenancies (or functional areas in single-tenanted buildings) Corrective Action Plan: Based on a review of the items above, areas of concern are to be highlighted and a corrective action plan produced detailing timelines and milestones.
Operational Guidelines	1 point is awarded if the Owner/ Landlord issues a guideline with recommendations for tenants / departments within the building with regards to: • Fit-out Considerations for Acoustic Comfort • Space Utilization for Acoustic Comfort
Quantitative Acoustic Testing	1 point is awarded where an acoustic specialist undertakes the following: • Identifies 'worst case' regularly occupied spaces* in terms of noise impact from external noise sources and building services supplied by the landlord or building owner. • Conducts Noise Level Testing in such 'worst case areas' to demonstrate that internal noise levels are within 2 dBA of the maximum equivalent continuous rating levels as set out in SANS 10103:2008. • Where areas are shown to be non-compliant as above, demonstrates that such areas account for less than 10% of the GLA. • Confirms through noise level testing where appropriate that noise from building services plant does not exceed the recommended levels of noise in districts as set out in SANS 10103:2008 at the property boundary or does not exceed the existing baseline ambient noise level (8h Laeq) by 3dBC at the property boundary, or demonstrating compliance with provincial noise control regulations where applicable. ** See definition below*

Regularly occupied Spaces
Regularly occupied spaces shall be defined for the purpose of this credit as all spaces where a person is expected to work, or remain for an extended period of time, including, but not limited to:

- Offices, either open plan or individual;
- Classrooms, lecture halls, theatres, auditoriums and court rooms;
- Computer labs;
- Commercial kitchens and preparation areas where food is sold;
- Retail / sales floor, exhibition halls, multi-purpose rooms, common areas in retail and exhibition buildings.
- Industrial spaces, warehouse areas, shop floors, workstations;
- Hospital wards, procedure rooms, waiting areas

DOCUMENTATION REQUIREMENTS

Criteria	Documentation
High-Level Acoustic Audit	**Completed Submission Template** confirming that all 5 required areas were reviewed as per the credit criteria. **Audit report summary** (max 5 pages) highlighting areas of concern as found through qualitative audit. **Corrective Action Plan** listing all problem areas noted with associated actions with milestones or completion dates.
Operational Guidelines	**Completed Submission Template** confirming that both fit-out and space usage considerations have been included in the tenant guidelines. **Copy of Guidelines** issued with regards to acoustics
Quantitative Acoustic Testing	**Acoustic Specialist Report** confirming the following: • Detailing the 'worst case' areas selected for testing • Detailing the test results • Confirming compliance with the credit criteria

ADDITIONAL GUIDANCE

High-Level Acoustic Audit
The purpose of this audit is to identify problem areas at a high-level. The intention is not for this audit to necessarily require specialist input but for the facilities management team to conduct a self-

assessment. Where areas of concern are highlighted, specialist reviews may for example be recommended as a first step in the corrective action plan.

The building audit must at a minimum investigate the following areas:

1. Occupant Feedback (Acoustic Survey)
    - Where an occupant comfort survey has been conducted as per the IEQ-4 Occupant Comfort credit, any acoustic concerns highlighted in the survey should be investigated in terms of the locality of the issue and the source of the concern.
    - Where the IEQ-4 Occupant Comfort Survey credit is not targeted, an acoustic survey must be conducted with building occupants in order to highlight potential problem areas. The requirements of this survey in terms of sample size must align with the IEQ-4 Occupant Comfort Survey credit.

2. Impact of Plant / Equipment Noise on Occupants
   Noise impact of building services provided by the landlord should be reviewed and any concerns highlighted. Possible solutions should be highlighted where problem areas are noted. Examples of such plant includes HVAC equipment, plant rooms, Fresh air fans and Fan Coil Units in tenant spaces, non-emergency generators, etc. Some recommended review approaches are as follows:
    - Note where occupant feedback has highlighted plant noise as a concern or where complaints are received from areas in close proximity to building services plant.
    - Highlighting where large plant (e.g. chillers, cooling towers, etc.) is in close proximity to regularly occupied spaces.
    - Basic preliminary testing of noise levels in regularly occupied areas outside of occupied hours with plant running. Such testing could for example be done by the FM team using a simple decibel meter. Problem areas may be those where noise levels significantly exceed the maximum equivalent continuous rating levels as set out in SANS 10103:2008 (e.g. 45 dBA for general office areas and 55 dBA for general retail areas).

3. Impact of Plant / Equipment Noise on Surrounding Properties
   Noise impact on surrounding properties of building services provided by the landlord should be reviewed and any concerns highlighted. Possible solutions should be highlighted where problem areas are noted. Examples of such plant includes HVAC equipment, plant rooms, non-emergency generators, etc. Some recommended review approaches are as follows:
    - Note where complaints or feedback have been received from neighbours in the past.
    - Highlight where large plant (e.g. chillers, cooling towers, etc.) is in close proximity to neighbouring properties.
    - Basic preliminary testing of noise levels can be undertaken by the FM team. Such testing could for example be done using a simple decibel meter. Problem areas may be those where noise levels significantly exceed the recommended levels of noise in districts as set out in SANS 10103:2008 at the property boundary (e.g. 55 dBA during the day in urban districts and 65 dBA during the day in central business districts).

4. Impact of External Noise Sources on Occupants
   Investigate spaces adjacent to known external noise sources (e.g. highways) in terms of their noise impact, and what possible solutions are available where noise is problematic. Some recommended review approaches are as follows:
   - Note where occupant feedback has highlighted external noise sources as a concern or where complaints are received from areas in close proximity to known external noise sources.
   - Highlighting where external noise sources are in close proximity to regularly occupied spaces.
   - Basic preliminary testing of noise levels can be undertaken by the FM team. Such testing could for example be done using a simple decibel meter. Problem areas may be those where noise levels significantly exceed the maximum equivalent continuous rating levels as set out in SANS 10103:2008 (e.g. 45 dBA for general office areas and 55 dBA for general retail areas).

5. Noise Transference Between Tenancies (or functional areas in single-tenanted buildings)
   Investigate acoustic qualities of tenancy dividing walls and highlight any concerns regarding transference of noise between tenants. Possible solutions should be highlighted where problem areas are noted. Some recommended review approaches are as follows:
   - Note where occupant feedback has highlighted noise from neighbouring tenancies or functional spaces a concern.
   - Note where dividing walls have lightweight uninsulated construction or do not extend to the underside of the roof or soffit.

Corrective Action Plan
Based on a review of the 5 items above, a clear corrective action plan must be produced which highlights areas of concern and sets out proposed solutions with associated timeframes.

Note that it is not necessarily required that physical mitigations are immediately put in place, but the most appropriate actions for the specific building's physical and operational context should be applied. In some cases this may be further investigation by specialists, in some it may be physical intervention and in others it may be operational interventions or strategies as physical intervention is not financially feasible in the short term.

Operational Guidelines*

Reward is given to owners/landlords who issue guidelines to their tenants or departments within the building (owner-tenanted building) regarding acoustic considerations. The following areas must be covered within this guideline:

Fit-out Considerations for Acoustic Comfort
Guidelines are required which set out recommendations to tenants (or departments) on their fitout to ensure that the space is acoustically comfortable for occupants to perform their tasks satisfactorily. The guidelines should address issues relating to:

- Reverberation
- Speech Privacy
- Noise Transference Between Spaces

Some potential examples of strategies to consider are given below. Note however that strategies should be selected based on the space in question. Projects may wish to enlist an acoustic specialist in compiling such guidelines for tenants.

- Consideration of sound absorbing materials such as ceiling tiles
- Consideration of partitioning or screens in open plan layouts
- Consideration of minimizing 'hard surfaces' in order to avoid reverberation (especially in meeting rooms
- Consideration of privacy areas for activities such as meetings, phone-calls and informal discussion
- Consideration of partition walls between meeting rooms and offices (e.g. extending to underside of soffit to avoid noise transference through ceiling)
- Recommendations on acoustic specialists to be consulted in fit-out if necessary.

Space Utilization for Acoustic Comfort

Guidelines are required which set out recommendations to tenants (or departments) detailing how best to make use of the space in order to ensure that the space is acoustically comfortable for occupants to perform their tasks satisfactorily.

Some potential examples of strategies to consider are given below. Note however that strategies should be selected based on the space in question. Projects may wish to enlist an acoustic specialist in compiling such guidelines for tenants.

- Areas of the building where tenants should be sensitive to noise levels in terms of the tasks performed. For example areas where dividing walls are known to be problematic or spaces adjacent to 'quiet spaces' such as libraries.
- Highlighting the building's potential privacy areas for activities such as meetings, phone-calls and informal discussion.
- Highlighting building operating procedures and guidelines surrounding noise. E.g. the use of amplified equipment, operating hours with respect to noise levels, etc.
- Indicating procedures and channels for tenants to make the building management team aware of any concerns regarding acoustics.

**Note that projects may wish to consider the issuing of such acoustic guidelines to tenants as part of the 'Building User Guide' as per the Man-3 Building Management credit.*

Acoustic Specialist

An Acoustic Specialist (required for quantitative testing) must have a thorough knowledge of the specific credit area(s) and must be a registered Professional Architect or Professional Engineer or Professional Technologist with relevant registration institutions, or have a relevant tertiary qualification from a publically recognized institution.

BACKGROUND

Internal noise is a significant factor in terms of occupant satisfaction and wellbeing. It can have a major influence on productivity in the workplace and is recognised as a health hazard by the World Health Organisation.

EB-IEQ-5 Acoustic Quality

POINTS AVAILABLE 3

Sound is measured in terms of pressure levels to which the human ear is extremely sensitive. The measure used is the decibel (dB). On this scale 0dB corresponds to the lowest possible audible sound and 140dB to the level at which pain will occur. The scale is not linear and an increase of 3dB corresponds to a doubling of the sound intensity whilst an increase of 10dB is perceived as an approximate doubling of the loudness of the sound.

The level of ambient sound may affect speech communication or, in extreme conditions, the effectiveness of a public address system. Control of the ambient sound level and limiting reverberation times are required to achieve good communications.

On the other hand, spaces such as offices and restaurants may benefit from some continuous ambient sound, which may assist in providing privacy between adjacent groups of people or in reducing distraction where people are concentrating on some particular task.

Noise level usually lies in the range between 30dB(A) and around 100dB(A) with levels above 85dB(A) capable of causing some permanent loss of hearing. Noise levels fluctuate and a number of scales are used to represent this. These scales are referred to as dB L scales.

- LAeq – This scale measures the average energy of the noise level. It is the equivalent steady state level of a fluctuating noise level. When considered over a period of time T, this is represented by the scale dB LAeqT.
- LA90 – This scale measure the level that is exceeded for 90% of the time.
- LA10 – This scale measures the level that is exceeded for 10% of the time i.e. the louder end of the noise range only.

Ambient noise level is a measure of 'background sound' that tends to be of low intensity and is present for most of the time. In a building, it can be defined as the noise level in a space caused by a composite of sounds from HVAC, equipment, lighting systems, computers, activity noises and the like, but excluding specific sources of interest, such as a person talking in an adjacent space. Excessive amounts of ambient sound can cause stress, which can impede an individual's ability to work well or to be comfortable.

REFERENCES & FURTHER INFORMATION

SANS Standards:

SANS 10103:2008 – The measurement and rating of environmental noise with respect to annoyance and to speech communication, SABS Standards Division, 2008
SANS 10083:2012 – The measurement and assessment of occupational noise for hearing conservation purposes, SABS Standards Division, 2012

Green Star SA . *Green Star SA – Public & Education Tool* . GBCSA Cape Town, 2013.

Green Star Australia. Green Star - Performance . Sydney, 2014

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

EB-IEQ-6 Daylight and Views

POINTS AVAILABLE 2

AIM OF CREDIT

To recognize the introduction of naturally lit spaces which provide occupants in regular occupied spaces with access to appropriate daylight and quality views for the activities being performed during the performance period.

CREDIT CRITERIA

Daylight Access and Glare Control	Up to 1 point is awarded where occupants in regularly occupied spaces have access to appropriate amounts of daylight, either by measurements or by deemed to satisfy calculations for the regularly occupied space during the performance period: 1 point for 30% of regularly occupied space
	0.5 points are awarded where occupants in regularly occupied spaces have installed operational features on glazed elements of the W, E & N facades that reduce the discomfort of glare from direct sunlight
Views and Lines of Sight	0.5 points are awarded where occupants in 30% of regularly occupied spaces have a clear line of sight to high quality internal (day-lit atrium) or external views, providing a connection between indoor space and the outdoors, as measured on plan.

For Retail Centres, the following applies:

- Points for daylight glare control and external views can be claimed as Not Applicable.
- Daylight Access - For retail areas, only the 'nominated area' need meet compliance. Note that for retail areas for the purposes of this credit, 'nominated area' is defined as internal public common area where there are tenants adjacent to the common space, uncovered or covered, and the area is considered a mall area (excluding car parks).
- Where the retail centre contains other uses, e.g. office areas, these office areas are to be assessed as per the criteria set out for daylight access. 30% compliance is to be achieved on the combination of retail 'nominated area' and other 'occupied spaces'. I.e. overall 30% is to be achieved.

Access to daylight and views have positive impacts or the occupants of existing buildings and can provide positive stimulation and a connection to the outdoors environment to them. It also assists to lessen visual fatigue from computer workstation operational requirements.

Regular occupied spaces are defined as spaces where people work, study or remain for an extended period of time, including:

- Offices, either open plan or enclosed space;
- Classrooms, staff offices, computer labs;
- Commercial kitchens and preparation areas where food is sold;
- Libraries, reading rooms, study halls,
- Industrial spaces: specifically break-out areas,
- Warehouse areas: specifically break-out areas,

Areas that for specialist functional reasons do not allow daylight may be excluded from compliance.

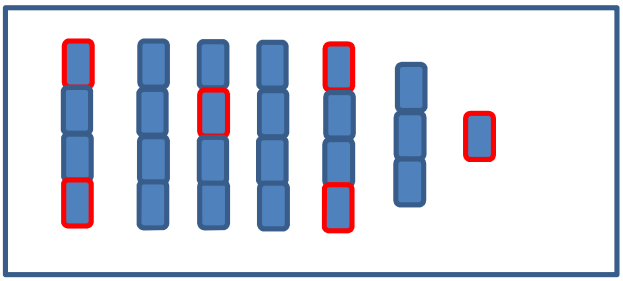
EB-IEQ-6 Daylight and Views

POINTS AVAILABLE 2

Option1- Daylight Measurement

Lux levels shall be recorded at work surface height (700mm above finished floor level) and the corresponding measurements indicated on floor plans or measurement tables.

For office areas, conference rooms, classrooms or any area with workstations, measurements shall be taken at 25% (rounded up) of the work stations evenly distributed throughout the area. The measurement shall be taken with the lux meter pointing vertically on the workstation. For example if you had a classroom with 24 desks you would need to take six measurements at six evenly distributed desks representing every area of the room:
23 x 25% = 5.75, therefore rounded up to 6 sample readings needed. The example below shows red blocks as readings.



Example: Sample lux measurements on workstations

The measurements taken for the internal space must indicate that 30% of all measurements taken in regularly occupied areas must have a daylight level of 200lux or more. Measurements need to be performed with all artificial lighting off.

Note: Where taking measurements with artificial lighting off is impractical due to continual operational requirements or as in multi-tenanted buildings, the option for the deemed to satisfy approach should be considered.

All readings to be indicated on a floor plan showing workstation layouts or tabulated and accompanied by a confirmation from the auditor that the above methodology has been employed.

The measurement data shall be counter signed by the building owners' Facility Management Representative or suitable owner representative based on a representative verified sample to ensure the validity of the data.

Option 2 Criteria of Building Characteristics for Daylight (deemed-to-satisfy)

It is also acceptable to display the following in the building's characteristics:

- At least 40% of the longest external building façades are made up of transparent or translucent glazing.
- Indicate that in terms of space planning - internal partitions over at least 60% of the floor area of the existing building are no more than 1,5m in height (open plan)
- Demonstrate that the footprint depth of the building floor plan or separate wings of the floor plan is no more than 12.5m from the longest external façades with 40% glazing. See Figure 1.

EB-IEQ-6 Daylight and Views

POINTS AVAILABLE 2

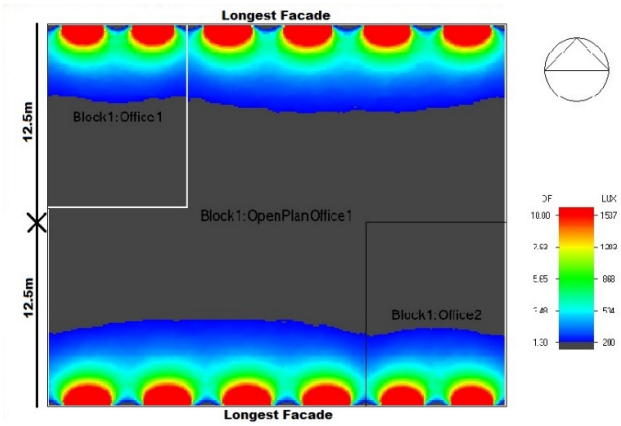


Figure 1- Building with 25m depth and 40% fenestration on both longest sides can typically be deemed to have sufficient daylight penetration.

Glare-control:

For all buildings pursuing this credit criterion, provide daylight redirection and/or glare control devices as follows to avoid high-contrast situations that could impede visual tasks:

- Northern, Western and Eastern Facades:
  External Shading Devices or Adjustable Blinds
- South Facades: none required

View and Line of Sight Measurement

Demonstrate to achieve direct line of sight to the outdoor environment or an atrium of at least 8m wide by means of transparent perimeter vision glazing in a zone between 1,2 to 1,5m above the finished floor for building occupants in [30%] of all regularly occupied areas. Determine the area with direct line of sight by totalling the regularly occupied square meters that meets the criteria below.

The following are conditions to be considered and addressed in the calculations:

- In plan view, the area is within sight lines drawn from perimeter vision glazing; unblocked by solid structures- there must not be another building within 8 m of the perimeter
- The area behind any solid portion of the external wall or atrium must be excluded from the calculations and
- The sightline is to be measured by extended an perpendicular line from the atrium or window, a 45 degree line can be used at the corners of the window see diagram:

EB-IEQ-6 Daylight and Views

POINTS AVAILABLE 2

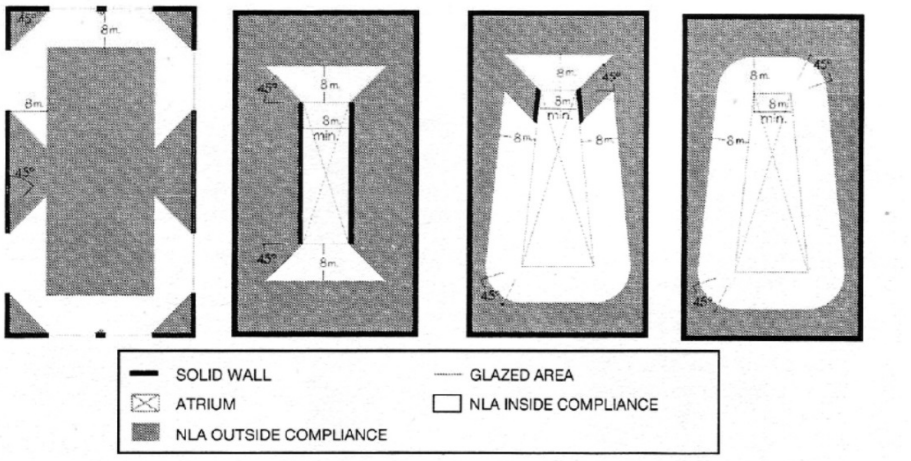


Figure 3- 8m width of view areas for different atrium shapes.

- Line of sight may be drawn through interior glazing.
- For private offices, the entire square meterage of the office can be counted if 75% or more of the area has direct line of sight to perimeter vision glazing.
- For multi-occupant spaces, the actual square meters of the areas with direct line of sight to perimeter vision glazing is counted as above.
- Compliance with the requirement within this credit can also be demonstrated through compliance of a representative floor if floors are typical.

DOCUMENTATION REQUIREMENTS

Submit all evidence and ensure it readily confirms compliance; also complete online submission template/check list.	
Criteria	**Documentation**
Daylight	• **Short Report** containing: Tables of measurement results or summary of deemed to satisfy calculations with evidence. List of measurements taken with total number of measurements below and above the 200 lux threshold indicated. Calculations for deemed-to-satisfy approach with photographic evidence of the façade fenestration percentages, drawings/photos of typical space planning and depth of building.
Glare Control	• **Short Report** containing: For all facades with glazing; indicate or describe areas where Glare Control devices are installed and append photographic evidence.

EB-IEQ-6 Daylight and Views

POINTS AVAILABLE 2

External Views	• **As-built drawings** with space planning marked up with lines of sight as per Figure 3 above clearly highlighting compliant areas. • **Short Report** with diagrams/tables of calculations

ADDITIONAL GUIDANCE

Opportunities, possible interventions and solutions:

- Use a combination of side-lighting and/or top-lighting to achieve a total Day lighting Zone (that floor area meeting the following requirements) that is at least [60%] of all the regularly occupied spaces.
- Windows or skylights can be inserted in the facade or roof or added to existing buildings; if these are added to the building envelope:
    - Glare control and solar heat gain however must also be controlled so that the interventions do not cause other environmental problems.
    - Sunlight re-direction can also be applied such as screening or introduction of light shelves.
- Space planning: layouts of space planning can be changed to allow more views and daylight access, open plan areas can be created by modifying layouts regarding enclosed office space with corridors.
- In some instance atriums can possibly be inserted into very deep space with suitable directed day lighting from skylights

Day lighting Zone:
In certain buildings such as high-rise buildings with a typical floor plate, the floor may be representative of the typical daylight access found throughout the entire premises.

Daylight Glare control:
Projects can use either fixed external shading devices or internal blinds to achieve this credit.

BACKGROUND

It is commonly understood that access to daylight and views result in positive impacts for building occupants. One of the reasons for these positive impacts is that access to daylight in regularly occupied areas, may give building occupants a circadian stimulus and a connection to the outdoors.

The impact of circadian rhythms on human productivity and health is well documented. These rhythms are based on the body's understanding of the time of day, which is driven by access to daylight. The natural changes in light that occur over the course of the day drive the circadian rhythms and remind the body that it is not evening.

Additionally, access to daylight and views in regularly occupied spaces, can contribute to diminished 'visual fatigue'. Simply put, visual fatigue is a feeling of weariness resulting from visual tasks in an indoor space. Access to views also connects the indoor space to the outdoors.

While daylight is generally accepted as beneficial by improving the internal environment and saving on artificial lighting energy, it can also cause significant glare problems. Direct sunlight or patches of sunlight on internal surfaces, including reflections of windows on computer screens, can cause

discomfort due to glare. The provision of shading devices and blinds can overcome this problem and the latter offering the occupant control to deal with local glare.

REFERENCES & FUTHER INFORMATION

Web-Sites:
http://www.cibse.org
CIBSE (Chartered Institution of Building Services Engineers, UK (1999) Publications: Day-lighting & Window design

Printed Media:
GBCA Australian Green Star Draft Performance tool (for Board Approval)
LEED Reference Guide for Green Building Operations and Maintenance for the Operations and Maintenance of Commercial and Institutional Buildings 2009 Edition (Updated April 2010)
LEED Canada for Existing Buildings: Operations and Maintenance 2009

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

EB-ENE-1 Energy Consumption (GHGE)

POINTS AVAILABLE **25**

AIM OF CREDIT

To encourage the reduction of greenhouse gas emissions associated with the use of energy in building operations.

CREDIT CRITERIA

Minimum Requirement	To be eligible for any points in this credit, 12 months of historic energy consumption data for the building must be available.
Energy Performance	A total of 25 points may be awarded where percentage reductions in energy consumption are achieved during the performance period. Points are awarded based on the level of the building's actual energy efficiency performance against benchmarks or historical performance. In addition to points achieved above, where the full 25 points are not achieved: 1 point is awarded where there is a proven energy saving for the performance period compared to the previous 12 months. 1 additional point is awarded where there is a proven energy saving of 10% or more for the performance period compared to a 12 month period within the last 3 years.

Performance period
Performance period relates to the continuous time period during which a credit is measured or data is collected. For Green Star SA – Existing Building Performance certification, the performance period is the most recent 12-month period of operations preceding the submission for certification.

The end of the performance period data-set should not be older than 3 months at the time of submission.

Note: the ENE and Water Data need not be from the exact same period, provided the point above applies.

Minimum requirement – Collect metered energy consumption data for the last 12 months of the building's operation.
Energy consumption data for the past 12 months must have been collected in order for the minimum requirement criteria in this credit to be met. This data will be used to measure against industry benchmarks and quantify improvements in energy consumption during the performance period, for which points will be awarded.

Sources of acceptable data
Energy consumption data collected for the building must be verifiable with sources such as Municipal or Eskom accounts for correctness. Alternatively, signed verification from a utility metering contractor (outsourced or in-house) may be presented.

EB-ENE-1 Energy Consumption (GHGE)

POINTS AVAILABLE **25**

Collected energy data must cover the energy use associated with the whole building, including source information (e.g. Municipal, Solar, Diesel Generators etc.) Buildings producing their own energy on site must indicate the alternative/renewable energy component separately from the traditional energy sources.

If there are any missing accounts or data points, the missing data point may be interpolated for completeness by using the average of the actual information available. A maximum of 3 months in the 12 month period may be interpolated.

Energy use must include all building energy consumption; this could include but not be limited to:

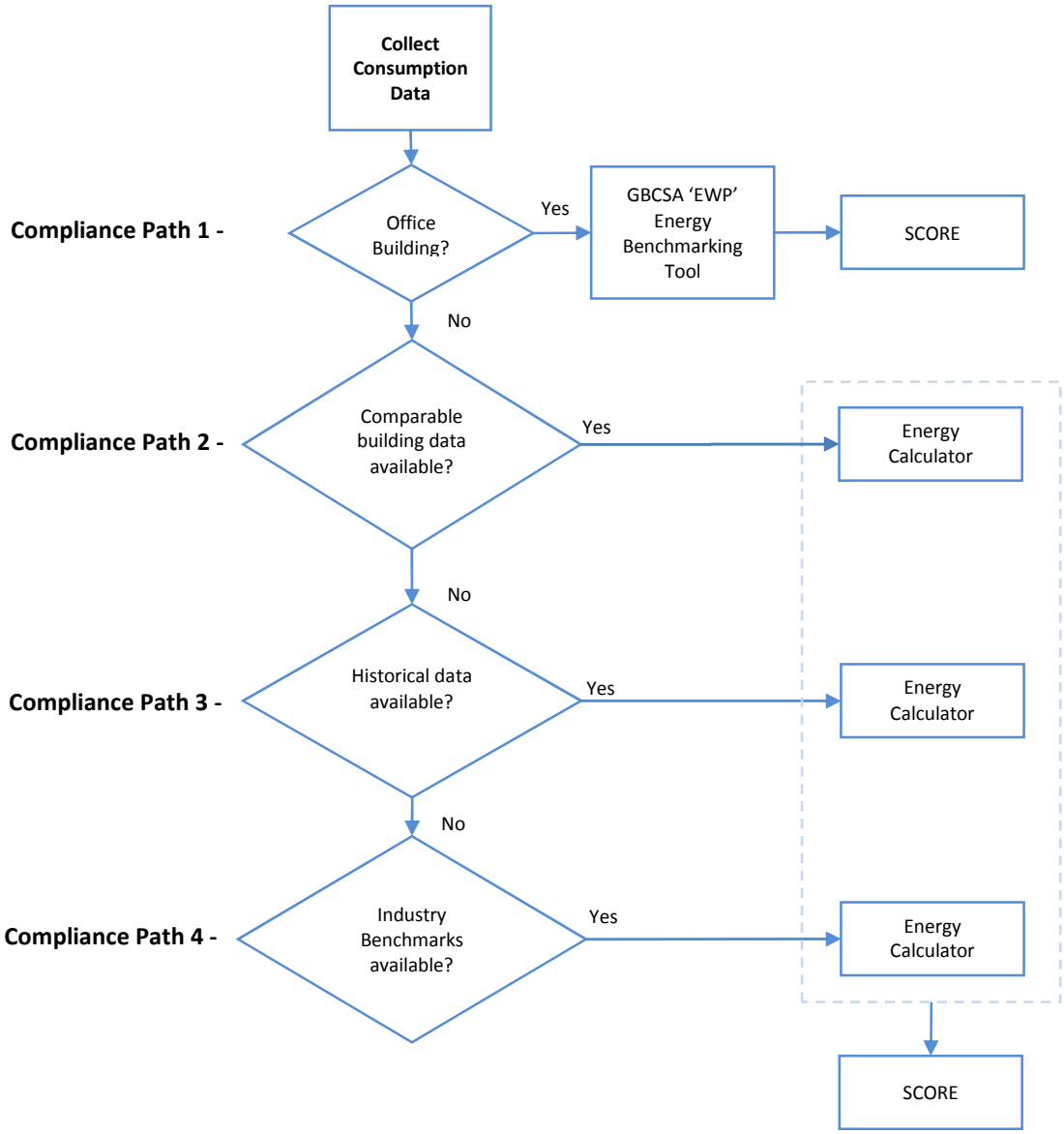
- all common areas,
- air-conditioning and plant
- Vertical Transport
- Tenant sub-metered areas
- external lighting

Municipal/Eskom Accounts
Data from utility accounts (as opposed to metered data) will only be accepted if no more than 3 months of data in the 12 month period is estimated.

Compliance Paths
For the purposes of this credit, there are four options for establishing an energy consumption benchmark for the building as outlined in the figure overleaf.

Note that only one compliance path may be followed.

Figure 1. Compliance path flow diagram



EB-ENE-1 Energy Consumption (GHGE)

POINTS AVAILABLE **25**

COMPLIANCE PATH 1: GBCSA 'EWP' ENERGY BENCHMARKING TOOL (office buildings)

EWP is the GBCSA's Energy & Water Benchmarking Tool which can be accessed on the GBCSA's website (https://www.gbcsa.org.za/other-tools/energy-water-benchmark/).

If the EWP Tool makes provision for your building type (currently provides ratings for office buildings), this tool must be used to benchmark your building's performance.

The EWP Tool is an operational performance measurement tool which rates the performance of a whole building, by comparing the energy usage figures against a national "average" benchmark that is normalised for the following factors:

- Climate;
- The number of computers;
- The number of occupants;
- The annual vacancies;
- Operating hours.

The building rating is positioned on a 10 level scale based on its performance relative to the benchmark. The calculator automatically translates the score achieved out of 10 to the number of points scored under this credit (out of 25) on the Energy Results tab.

To summarise, for Compliance Path 1, the following procedure must be followed:

1. Collect 12 months of energy consumption data
2. Benchmark office building using the EWP Tool (ensure that detailed inputs are completed, accounting for vacancy)

Compliance Path 1 Resources:

Resource	Description	Location
EWP Tool	Use to benchmark building performance	http://www.gbcsa.org.za/other-tools/energy-water-benchmark/
EWP Guidelines	Provide details on how to use benchmarking tool	http://www.gbcsa.org.za/other-tools/energy-water-benchmark/

EB-ENE-1 Energy Consumption (GHGE)

POINTS AVAILABLE **25**

COMPLIANCE PATH 1 POINTS:

Points are awarded from a EWP score of 5 and up. The table below illustrates how points are awarded based on % improvement on a EWP score of 5.5.

% Improvement over EWP score 5.5	ENE-1 Points
-12,0%	2
-7,1%	3
-2,3%	4
2,6%	5
7,5%	6
12,3%	7
17,2%	8
22,1%	9
26,9%	10
31,8%	11
36,7%	12
41,5%	13
46,4%	14
51,2%	15
56,1%	16
61,0%	17
65,8%	18
70,7%	19
75,6%	20
80,4%	21
85,3%	22
90,2%	23
95,0%	24
100,0%	25

COMPLIANCE PATH 2: COMPARABLE BUILDINGS
(For building types NOT covered by GBCSA 'EWP' tool)

As not all building-types may be covered by the EWP Tool. Other premises can still qualify for points under this credit by following the point scoring path as described below.

Energy consumption baseline from 'comparable building' energy data
An energy consumption baseline must be determined from historical data of at least two (2) other comparable buildings in the same climatic zone. 'Energy' encompasses all the energy types used in powering these buildings, including electricity, gas, oil or diesel. Historical data from at least one (1) recent year period shall be used for the calculations.

The energy performance baseline determined using this option, will represent the 'average performer' against which the premises seeking Green Star certification will be compared. Percentage differences will then be calculated in 5% increments as per **Error! Reference source not found.** to allow for improvements to be measured over time.

The following process must be followed for each of the 2 comparable buildings:

I. Determine if the building being used to create the baseline is of 'comparable use' to the premises seeking Green Star certification as per guidelines provided here and in 'Energy Calculator Guide' available on the Certification Engine;
II. Collect historical monthly energy data, from recent year covering the major energy sources used by the comparable buildings as well as 12 months of data for the building being rated;
III. Collect 'Energy Variance Factor' info (see below) for all buildings and ensure comparable or suitably normalised (complete checklists in submission template and fulfil documentation requirements);
IV. Use 'Energy Calculator' available on the Certification Engine to enter data and calculate score.

Determining comparable buildings
Comparable buildings are defined as buildings in the same climatic zone that have the same primary use and that have similar operating characteristics.

This means that if the primary use of the building under investigation is defined as a "Restaurant", the primary use of the buildings used in the comparison must also be "Restaurant". Primary use is defined as at least 70% of the Gross Lettable Area (GLA) of a building having the same use. Where buildings are characterised by mixed-use if no single primary use covers 70% of the GLA an area weighted approach may be used (see 'Mixed Use Buildings' after Compliance Path 4 resources).

Comparable buildings shall be defined in terms of the following variables:

1. Type of building (same)
2. Use of building (same)
3. Climatic zone (same)
4. Hours of operation (within 15%, or normalised)
5. Occupation rate (m2 per person) (within 15%, or normalised)
6. Natural Ventilation / HVAC systems (same)
7. Vacancy Rate (within 10% of total occupation percentage or normalised)

EB-ENE-1 Energy Consumption (GHGE)

POINTS AVAILABLE **25**

Below is a table extracted from the Submission Template which must be completed in order to demonstrate that the buildings are in fact 'comparable'.

Table 1: Variance Factors for Comparable Buildings (to be completed in Submission Template)

Energy Variance Factor	Do 'comparable buildings' align with respect to the following variance factors?		If no, has a suitably qualified professional applied appropriate normalising to the benchmark in this regard?	
	Y	N	Y	N
Building Usage (E.g. Retail)			N/A	
Hours of operation (within 15%)				
Occupant density (within 15%) e.g. m2 per person				
Vacancy rate (%) within 10% of total occupation %. I.e. 10% and 20% vacancy considered comparable.				
Number of beds (Hospitals, Hotels, Dormitories, etc.)				
Other common denominator energy consumers (Lifts, escalators, MRI machines, walk-in refrigerators,				
Ambient conditions (within same climate zone)			N/A	
HVAC system (mechanical / natural / mixed)				
Other: (specify)				

Note that to be deemed 'comparable', each of the energy factors listed above must either align for the comparable building and actual building, or must be normalized for.

Methods of Normalising

Based on the table above, should any normalising be required for the 'comparable building' baseline, such normalising must be conducted by a suitably qualified professional (Mechanical / Electrical Engineer or Technician with min 3 years relevant experience in Energy benchmarking, or a Measurement & Verification (M&V) professional). A guideline of a suggested simplified normalising methodology is provided under 'Additional Guidance'.

Collecting area information

Gross Lettable Area (GLA) data must be collected from comparable buildings to allow for the establishment of the baseline. This data must be presented in square metres and be verifiable from floor plans or measurements obtained from site.

The GLA will be required to "normalise" the collected energy data to an energy per square metre unit. For building types where GLA may not be the most sensible means of comparing energy performance, applicants may use alternative comparison approaches for approval. For example in Healthcare it may be energy consumption per bed.

Collecting hours of operation
The 'hours of operation' of a building is an important variable in determining the baseline that can be used for comparisons. 'Hours of operation' means the total number of hours a week a building is fully able to be used for its main purpose.

The building under investigation is to be used as the point of reference for this comparison. This means that if the building under investigation typically operates Monday to Friday from 8am to 6pm (50 hours a week), the hours of operation of the comparable building should ideally also operate in the vicinity of 50 hours a week.

It is understood that the comparison building may not have the exact same 'hours of operation'. Where hours of operation vary significantly, these can be normalised for.

Climate zones
To mitigate against the influence of different climate and weather conditions that may influence a building's energy use, only buildings from the same climate zone as defined by SANS 204 and 10400-XA shall be used for comparison.

Other operational characteristics
Variables that could explain how energy is consumed by building operations must also be collected for all buildings and shown to be comparable (as detailed above).

Where the specific building type may have an operational characteristic not listed above which is likely to affect energy performance significantly, this should be collected and shown to be comparable between the Comparable buildings, or be shown to be adequately normalized for.

To summarise, for Compliance Path 2, the following procedure must be followed:

1. Identify 2 'comparable buildings' (as per guidelines provided here and in Energy Calculator)
2. Collect energy consumption and other required data for 2 buildings as well as the building being certified
3. Use the Green Star SA – Existing Building Performance Energy Calculator to benchmark the building seeking certification against the 2 comparable buildings.

Compliance Path 2 Resources:

Resource	Description	Location
Existing Building Performance Energy Calculator	Use to benchmark building seeking certification against 2 comparable buildings and to determine final score for this credit	www.certificationengine.org

COMPLIANCE PATH 3: HISTORICAL DATA

(For premises NOT covered by the EWP tool, and where no comparable building data is available)

Historical data from a baseline year that occurred within the last ten (10) years can be selected by the Applicant as the baseline for the building. The data from the selected year will present the 'average performance' for the particular premises. The performance period data will then be evaluated against the average performer.

Percentage differences will then be calculated in 5% increments to allow for improvements to be measured over time.

The process as described in Compliance Route 2 above to collect data shall also be followed for Compliance Path 4.

Demonstrating Validity of Baseline

Below is a table extracted from the Submission Template which must be completed in order to demonstrate that the baseline year selected is in fact representative for benchmarking.

Table 2: Changes in Energy Variance Factors (to be completed in Submission Template)

2. Complete 'Validity of Baseline Checklist' Below				
Energy Variance Factor	**Have any of the following factors changed significantly since the Historical Baseline Period?**		**If yes, has a suitably qualified professional applied appropriate normalising to the baseline in this regard?**	
	Y	**N**	**Y**	**N**
Building Usage (E.g. Community Retail Centre)			N/A	
Hours of operation (within 15%)				
Occupant density (within 15%) e.g. m2 per person.				
Vacancy rate (%) within 10% of total occupation %. I.e. 10% and 20% vacancy considered comparable.				
Number of beds (Hospitals, Hotels, Dormitories, etc.)				
Other: (specify)				

Note that to be deemed a representative baseline year, each of the energy factors listed above must either align between the baseline year and the performance period, or must be normalized for.

Methods of Normalising

Based on the table above, should any normalising be required for the baseline year, such normalising must be conducted by a suitably qualified professional (Mechanical / Electrical Engineer or Technician with min 3 years relevant experience in Energy benchmarking, or a Measurement & Verification (M&V) professional). A guideline of a suggested simplified normalising methodology is provided under 'Additional Guidance'.

To summarise, for Compliance Path 3, the following procedure must be followed:

1. Collect historical energy consumption data for the building
2. Use the Green Star SA – Existing Building Performance Energy Calculator to benchmark the building against its own historical performance.

Compliance Path 3 Resources:

Resource	Description	Location
Existing Building Performance Energy Calculator	Use to benchmark building seeking certification against its own historical baseline and to determine final score for this credit	www.certificationengine.org

COMPLIANCE PATH 4: INDUSTRY BENCHMARKS

Where the GBCSA's 'EWP' Energy Benchmarking Tool does not cater for your building type, and no comparable building data or historical data is available, applicants can motivate a suitable industry benchmark for use to rate their building. (E.g. SANS 10400-XA/SANS 204, Energy Star® benchmarks, surveyed data from industry bodies, etc.)

Approved Benchmarks:
The GBCSA will also publish in this credit, industry benchmarks which have been approved for use in Compliance Path 4 as these are permitted for existing building projects. At this time, the following benchmarks are considered appropriate for application in this compliance path:

- **SANS 10400-XA 'Maximum Annual Consumption' Benchmarks** where applicable. (See 'Additional Guidance' for notes on applicability of these benchmarks.
- **Investment Property Databank (IPD) South Africa Energy Efficiency Benchmarks** where applicable
- **Energy Star Portfolio Manager Benchmarks** from appropriate climate zones

Whether using one of the benchmarks above or motivating a new benchmark, projects are required to complete the 'Benchmark Motivation Checklist' in the submission template (Table 3 and 4 below).

MOTIVATING A BENCHMARK

There are primarily three types of benchmarks which could be put forward for your building type, namely

- **Benchmarks based on statistical data**
- **Benchmarks based on calculated or simulated performance**
- **Published National / International Standards**

These are listed in the 'Benchmark Motivation Checklist' below (extracted from the Submission Template) along with the requirements for using either of these benchmark types.

Table 3: Benchmark Motivation Checklist (to be completed in Submission Template)

BENCHMARK BASED ON STATISTICAL DATA OR PUBLISHED STANDARDS:			
Benchmark Used (Version, Release date, Author, etc.)			
Requirements	**YES**	**NO**	**Comment**
Is this an appropriate benchmark for the building?			
Has the benchmark been independently developed (independent from the building owner company) by a credible third party institution?			
Are the sample buildings of the same usage type to the building seeking certification?			
Does benchmark adequately take into account energy variance factors (as set out in Table 4 overleaf), or are these factors adequately normalised for?			
BENCHMARK BASED ON CALCULATED OR SIMULATED PERFORMANCE:			
Benchmark Used (Version, Release date, Author, etc.)			
Requirements	**YES**	**NO**	**Comment**
Is this an appropriate benchmark for the building?			
Is the benchmark appropriate to the usage type of the building seeking certification?			
Does the benchmark adequately take into account energy variance factors within the calculation inputs and methodology (as set out in Table 4 overleaf) or are these adequately normalised for?			

NORMALISING THE BENCHMARK

As a general guide, the following variance factors must be taken into account by the chosen Benchmark where applicable.

Table 4: Variance Factors & Normalising (to be completed in Submission Template)

Energy Variance Factor	Does benchmark adequately account for the impact of this factor? If yes, state how.			If no, has a suitably qualified professional applied appropriate normalising to the benchmark in this regard?	
	Y	N	Comment	Y	N
Building size (GLA and Net Floor Area)					
Hours of operation					
Occupant density (e.g. m2 per occupant)					
Vacancy rate (%)					
Number of beds (Hospitals, Hotels, Dormitories, etc.)					
Other common denominator energy consumers (Lifts, escalators, MRI machines, walk-in refrigerators,					
Ambient conditions (location)					
HVAC system (mechanical / natural / mixed)					
Other: (specify)					

Note that to be deemed an appropriate benchmark, each of the energy factors listed above must be adequately accounted for in the benchmark, or must be normalized for.

Methods of Normalising

Based on the table above, should any normalising be required for the benchmark chosen, such normalising must be conducted by a suitably qualified professional (Mechanical / Electrical Engineer or Technician with min 3 years relevant experience in Energy benchmarking, or a Measurement & Verification (M&V) professional). A guideline of a suggested simplified normalising methodology is provided under 'Additional Guidance'.

To summarise, for *Compliance Path 4*, the following procedure must be followed:

1. Collect 12 months of energy consumption data

2. Source a suitable Industry Benchmark for the building, ensuring it is appropriate and normalised if required (complete checklists in submission template and fulfil documentation requirements)

3. Benchmark building against Industry benchmark using the Energy Calculator

Compliance Path 4 resources:

Resource	Description	Location
Existing Building Performance Energy Calculator	Use to benchmark energy consumption against Industry benchmarks and to determine final score for this credit	www.certificationengine.org

MIXED-USE BUILDINGS

The following methodology for mixed-use buildings (including sites or developments) shall apply to Compliance Paths 1 & 2:

- If 70% or more of a building's GLA comprises a single space type, the building's space use shall be defined by this type. If the building consist of more than one space type and no single space type is more than 70% of the GLA, then the relevant compliance path shall be used to rate each space type separately. The final score shall be a pro rata averaged based on the respective scores and floor areas.

  If a space type makes up less than 10% of the building's GLA, it can be excluded (both consumption and GLA) from the benchmarking calculation provided the sum of all excluded areas do not exceed 10% of the building GLA.

- Example 1: If the building comprises 90% Retail and 10% Office space, the primary use of the building shall be Retail.

- Example 2: If the building under investigation consists of 60% Office, 35% Retail and 5% residential - The office and retail components shall be benchmarked separately using the most appropriate compliance paths. The residential water consumption and floor area can be excluded from benchmarking exercise. The final score shall be calculated by adding the final scores for each space type averaged based on floor area of each space type.

COMPLIANCE PATH 2,3 & 4 POINTS:

Points are awarded based on % improvement as follows.

Table 5: Scoring Table – Compliance paths 2-4

Percentage improvement over Benchmark / Baseline	Points achieved
0%	2
2,5%	3
5%	4
7,5%	5
10%	6
12,5%	7
15%	8
20%	9
25%	10
30%	11
35%	12
40%	13
45%	14
50%	15
55%	16
60%	17
65%	18
70%	19
75%	20
80%	21
85%	22
90%	23
95%	24
100%	25

Note on Energy Performance Certificates
The SABS is currently developing a standard for Energy Performance Certificates (EPC's) in buildings and the intention is for these EPC's to be integrated into Compliance Path 2. Once EPC's are released and available to be issued by SANAS accredited organizations, this will be considered for inclusion in this compliance path.

Greenhouse gas emission factor data
The ultimate goal of this credit is to reduce the amount of greenhouse gasses produced through the use of energy. To this end the collected energy usage data is converted to their respective CO_2 emissions for the final comparison.

The table overleaf provides the kg CO_2 / kWh figures used in the calculator.

Table 6 CO2 emission of energy sources

Energy sources	kg CO_2 / kWh
Mains Electricity	1.2
Diesel	0.267
LPG	0.227
Natural Gas	0.202
Coal	0.354
Biogas	0.025
Town Gas (coal)	0.160

Renewable energy sources (excluding biomass) will be regarded as completely emission free for the purposes of this credit.

DOCUMENTATION REQUIREMENTS

Submit all evidence and ensure it readily confirms compliance; also complete online submission template/check list. Applicants must provide all documentation that supports their claims and calculations.

Criteria	Documentation
All	Completed Submission Template
Minimum Requirement	12 consecutive months of electricity consumption data to establish an energy consumption baseline
Compliance Path 1	• **Completed GBCSA 'EWP' Tool** Benchmarking Calculator (Offices) o Detailed input page to be completed and vacancies to be accounted for. • **12 consecutive months of electricity consumption data** (utility bills or meter readings signed off by contractor or facilities person responsible for meter readings)
Compliance Path 2	• **Completed EBP Energy Calculator** • **12 consecutive months of electricity consumption data** for all buildings (utility bills or meter readings signed off by contractor or facilities person responsible for meter readings) • **Short Report on Normalising Methodology** (where applicable) signed off by suitably qualified professional.
Compliance Path 3	• **Completed EBP Energy Calculator** • **12 consecutive months of electricity consumption data** for the baseline period and the Performance Period

	(utility bills or meter readings signed off by contractor or facilities person responsible for meter readings) • **Short Report on Normalising Methodology** (where applicable) signed off by suitably qualified professional.
Compliance Path 4	• **Completed EBP Energy Calculator** • **12 consecutive months of electricity consumption data** (utility bills or meter readings signed off by contractor or facilities person responsible for meter readings) • **Attach an extract from the publication / document detailing the benchmark used.** • **Short Report on Normalising Methodology** (where applicable) signed off by suitably qualified professional.
Additional Points	• **Historical electricity consumption data** (utility bills or meter readings signed off by contractor)

Further Evidence* that may be Requested by Assessors:

Energy Variance Factors such as:

- Proof of building area (GLA)
- Proof of number of occupants
- Proof of occupancy hours
- Proof of building address
- Proof of the type of operation conducted in the building

**Note that for Compliance Path 3, the above information may be requested not only for the building seeking certification, but for comparable buildings as well.*

ADDITIONAL GUIDANCE

Example of Simplified Normalising Method

Scaling factors are often employed to normalize variables to allow direct comparison between the baseline data and data of the building being rated. The typical formula for calculating scaling factors is shown below.

$$\textbf{Scaling factor}_{\textbf{Variable}} = \frac{\textbf{Value for Operating Variable for building to be rated}}{\textbf{Value for Operating Variable for Benchmark Buildings}}$$

Example – Operating hours

Benchmark Buildings = 80 hours

Building being rated = 85 hours

The calculation of scaling factor for Operating Hours will be:

$$\textbf{Scaling factor}_{\textbf{Operating Hours}} = \frac{85}{80} = 1.0625$$

This scaling factor can then be multiplied (or divided, depending on the application) to the comparison values to adjust it for comparison purposes. In some cases, the scaling factor will be applied to a portion (percentage) of the result due to the fact that the factor does not influence the total energy consumptions but only a portion. When this is applied, the logical methodology of why the scaling factor is applied to a certain percentage of the result is required.

It is understood that not all factors have a linear relationship with performance, but this simplified method is acceptable for the purpose of this tool.

Applicability of Using SANS Benchmarks

Note that not all building types within a specific SANS classification would be able to apply the SANS 10400-XA benchmarks equitably. As such, the guidance below seeks to further define the type of buildings that may use the benchmarks.

Building Classification	Type of buildings that can use these benchmarks	Occupancy
A1	Entertainment & Public Assembly Buildings >2000m2 with commercial kitchen facilities. These buildings would typically be air conditioned. E.g. convention centres, auditoria, restaurants, etc.	The standard occupancy for this building type is assumed to be full occupancy 18 hours a day, 7 days a week.
A2	Theatrical and indoor sport venues >1000m2. These venues would typically be air conditioned.	The standard occupancy for this building type is assumed to be full occupancy 18 hours a day, 7 days a week.
A3	Applies to tertiary education buildings that would typically be air conditioned.	The standard occupancy for this building type is assumed to be full occupancy 12 hours a day, 5 days a week.
A4	Places of Worship (typically not air conditioned)	The standard occupancy for this building type is assumed to be full occupancy 6 hours a day, 4 days a week.
F1	Retail Centre / store >2000m2	The standard occupancy for this building type is assumed to be full occupancy 12 hours a day, 7 days a week.
G1	Use GBCSA Energy Benchmarking Tool	
H1	Hotels larger than 50 rooms. Includes commercial kitchen facilities typically air conditioned.	The standard occupancy for this building type is assumed to be full occupancy 24 hours a day, 7 days a week.

EB-ENE-1 Energy Consumption (GHGE)

POINTS AVAILABLE **25**

Energy audit
Whilst not a specific requirement within the credit, it is recommended that an energy audit is conducted to establish where energy savings could be realized.

An ASHRAE level 1 energy audit would typically cover the following:

1. Summary
    2. Systems narrative
        a. Air distribution and ventilation systems
        b. Cooling systems
        c. Heating systems
        d. Building HVAC controls
        e. Domestic hot water system
        f. Lighting systems and controls
        g. Electrical distribution system
        h. Building envelope system
    3. Energy usage analysis
        a. Benchmark implications
        b. Irregularities in energy use
        c. Current occupancy rates
    4. Energy audit procedure and results
    5. Recommended energy efficiency measures

NATIONAL CONTEXT: To meet the conditional requirement the building must demonstrate energy performance equal to or better that the national building regulation benchmarks indicated in SANS 10400 XA.

In light of the increased demand on South Africa's electrical supply, Demand-side Management (DSM) and energy efficiency projects may be implemented by Energy Service Companies (ESCos) to achieve electrical savings and obtain rebate payments from Eskom. *Note: Eskom reviews the program from time to time and it may be continued in future.*

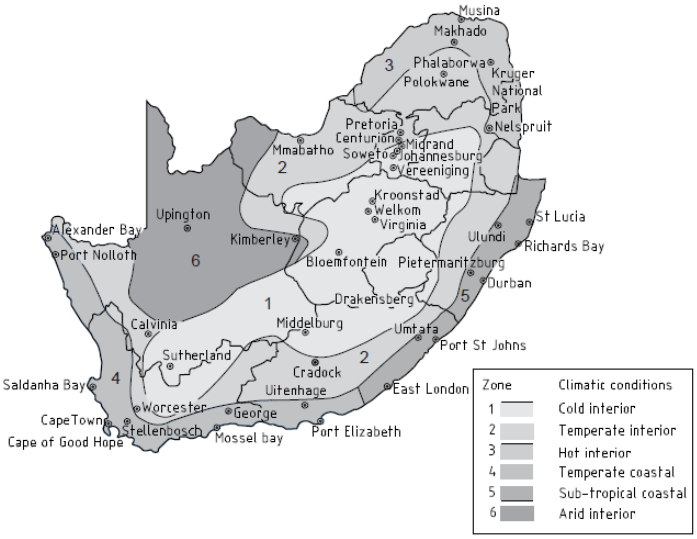
The metering installation forms a critical part of the measurement and verification process to quantify for rebates and determine the effectiveness of the DSM project. To this end, compliance with Eskom's PM/M&V/STD001 (currently under review) metering standard should be considered when selecting the metering standard and methodology for the building(s).

The application of the National Buildings Regulations standard, SANS 10400-XA-2011 provides the following performance levels based on the different climatic zones in South Africa.

Table 7. SANS 10400-XA Maximum Energy consumption table (1)

1	2	3	4	5	6	7	8
Classification of occupancy of building	**Description of building**	**Maximum energy consumption** kWh/m^2					
		Climatic zone					
		1	**2**	**3**	**4**	**5**	**6**
A1	Entertainment and public assembly	420	400	440	390	400	420
A2	Theatrical and indoor sport	420	400	440	390	400	420
A3	Places of instruction	420	400	440	390	400	420
A4	Worship	120	115	125	110	115	120
F1	Large shop	240	245	260	240	260	255
G1	Offices	200	190	210	185	190	200
H1	Hotel	650	600	585	600	620	630
NOTE 1 The annual consumption per square metre shall be based on the sum of the monthly consumption of 12 consecutive months. NOTE 2 Non-electrical consumption, such as fossil fuels, shall be accounted for on a non-renewable primary energy thermal equivalence basis by converting megajoules to kilowatt hours.							

Table 8. Climate Zone table (1)



Zone	Description	Major centre
1	Cold interior	Johannesburg, Bloemfontein
2	Temperate interior	Pretoria, Polokwane
3	Hot interior	Makhado, Nelspruit
4	Temperate coastal	Cape Town, Port Elizabeth
5	Sub-tropical coastal	East London, Durban, Richards Bay
6	Arid interior	Upington, Kimberley

ASHRAE Audits
http://www.energyadvantage.com/blog/2011/05/the-difference-between-ahsrae-level-1-2-3-energy-audits/

Additional information with regards to energy metering can be found under:

- MAN-6 Ongoing Monitoring and Metering

ENERGY STAR benchmarking tools
http://www.energystar.gov/

BACKGROUND

The per capita greenhouse gas emissions of South Africa are on average greater than our economic counterparts in the region. This can largely be attributed to our over reliance on coal for power generation. Balancing economic growth and the ever growing energy demand can only be achieved through the reduction in energy demands of new and existing buildings.

Reducing the energy demand has the added benefit of alleviating the current shortfall in electrical generation capacity in South Africa and reducing the strain on the generation and distribution infrastructure, minimising the future need for load shedding.

REFERENCES & FURTHER INFORMATION

1. **SOUTH AFRICAN NATIONAL STANDARD.** *SANS 10400-XA:2011 The application of the National Building Regulations, Part X: Environmental sustainability, Part XA: Energy usage in buildings.* Pretoria : SABS Standards Division, 2011.
2. —. *SANS 204:2011 Energy efficiency in buildings.* Pretoria : SABS Standards Devision , 2011.
3. —. *SANS 50001:2011 Energy managment systems - requirements with guidance for use.* Pretoria : SABS Standards Division , 2011.
4. —. *SANS 50010:2011 Measurement and verification of energy savings .* Pretoria : SABS Standards Division , 2011.
5. **Green Star SA .** GREEN-STAR-SA-PUBLIC-EDUCATION-BUILDING-RATING-TOOL. Cape Town : s.n., 2013.
6. **Green Star Australia.** Green Star - Performance . Sydney : s.n., 2013.
7. LEED, or Leadership in Energy & Environmental Design rating system by the U.S. Green Building Council (USGBC) http://www.usgbc.org/

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

EB-ENE-1 Energy Consumption (GHGE)

POINTS AVAILABLE **25**

EB-ENE-2 Peak Electricity Demand

POINTS AVAILABLE **2**

AIM OF CREDIT

To recognize operational practices that reduces peak demand on electricity supply infrastructure.

CREDIT CRITERIA

Minimum Requirement **Historical Peak Electricity Demand Data**	To be eligible for any points in this credit, historical peak demand data must be collected.
Peak Electricity Demand performance	A total of 2 points may be awarded where it is demonstrated that the building's Peak Demand Performance meets the required benchmarks set out in the credit (improvement on SANS 10400-XA where applicable, or improvement on a historical baseline where not).

Peak demand is a primary issue of concern for electricity supply networks, as it is a direct driver of network capacity requirements. In contrast to the variable nature of electricity demand, network capacity cannot be increased in the short-run to accommodate excessive periods of demand.

Compliance Paths
For the purposes of this credit, there are two options for establishing a Peak Demand benchmark for the building as outlined in the figure overleaf.

Note that only one of the following 2 compliance paths may be followed.

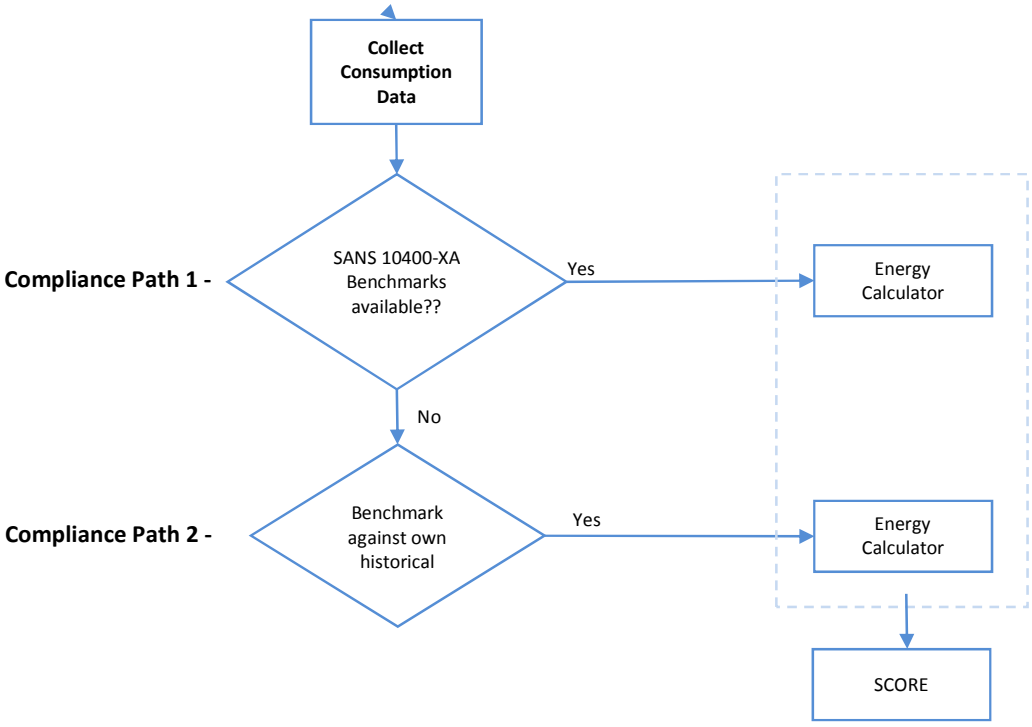


Figure 1. Compliance path flow diagram

COMPLIANCE PATH 1: SANS 10400-XA Peak Demand Benchmarks

SANS Benchmarks

Where comparable benchmarking figures exist in SANS 10400-XA for the building type, the listed figures in the SANS document shall be used within the ENE-2 calculator as a benchmark to compare your building's peak demand performance to. The corresponding SANS reference table is provided under the additional guidance section.

Note requirement to use Net Floor Area (NFA) in lieu of GLA for the SANS benchmarking.

Points shall be scored as per the table overleaf.

Table 1. Scoring Table - SANS Benchmarks

Improvement on benchmark	0 to 5%	5 to 10%	10 to 20%	Above 20%
Points Allocated for this credit	0.5	1	1.5	2

To summarise, for Compliance Path 1, the following procedure must be followed:

1. Collect historical Peak Demand data for your building
2. Enter data into Green Star SA – Ene-2 Peak Demand Calculator to obtain final score. Data must be entered for each full year. **Months in a year may not be left blank.**

COMPLIANCE PATH 2: Historical Benchmarking

Where no comparable benchmark figure exists in SANS 10400-XA or SANS 204, points shall be allocated as follows within the Ene-2 Peak Demand Calculator

	1 point	2 points
Criteria	1 point for peak electrical demand actively reduced by 10% over the baseline during the performance period	1 point is awarded if the difference between peak and average demand does not exceed 20%

For Compliance Path 2, Historical data from a baseline year that occurred within the last ten (10) years can be selected by the Applicant as baseline for the building. The data from the selected year will present the 'average performance' for the particular premises. The performance period data will then be evaluated against the average performer.

To summarise, for Compliance Path 2, the following procedure must be followed:

1. Collect historical Peak Demand data for your building
2. Enter data into Green Star SA – Ene-2 Peak Demand Calculator to obtain final score. Data must be entered for each full year. **Months in a year may not be left blank.**

EB-ENE-2 Peak Electricity Demand

POINTS AVAILABLE **2**

Standards for acceptable data
Standards for acceptable source data are provided below, in order of preference:

1. Utility accounts
    a. Utility accounts from the Municipality/Eskom showing consumption and demand figures for the performance period, including meter reading times/dates and meter identification. Note data from utility accounts will only be accepted if no more than 3 months of data per year is estimated.
    b. Electricity peak demand data must be recorded in the same units (either kVA or kW).

2. Non-Utility meters
    a. Summarised monthly demand figures for the performance period
    b. Readings obtained from non-utility meters must be signed off by the Metering Contractor (if outsourced), or relevant facilities management person responsible for meter reading (if in-house)
    c. Interval data must be measured in 15 or 30 min intervals to be acceptable

Multiple electricity meters
Where a building has multiple electricity meters all electricity meters must be accounted for in the energy consumption calculation. One meter at the main supply to the building will be used for peak demand verification. Evidence in the form of an electrical single line diagram or meter schedule which shows all meters in the building must be provided such that all meters can be reconciled against the source data.

Mixed use buildings
The following methodology for mixed use buildings shall apply:

- If 70% or more of a building's GLA comprises a single space type, the building's space use shall be defined by this type. If the building consist of more than one space type and no single space type is more than 70% of the GLA, then the relevant compliance path shall be used to rate each space type. The final score shall be a pro rata averaged based on the respective scores and floor areas.

EB-ENE-2 Peak Electricity Demand

POINTS AVAILABLE **2**

DOCUMENTATION REQUIREMENTS

Submit all evidence and ensure it readily confirms compliance; also complete online submission template/check list:

Criteria	Documentation
All	• **Completed Submission Template**
Peak Electricity Demand Performance	• **Copy of the Completed Ene-2 Peak Demand Calculator** AND • **Electrical Single Line Diagram and/or Meter Schedule** indicating metering CT ratios, locations and types Note: The item above need only be provided if not enclosed as part of MAN-6 credit submission

ADDITIONAL GUIDANCE / RESOURCES

Electricity accounts are generally made up of charges for the quantity of energy used (measured on kWh) and charges for peak demand (measured in kVA). Tariff charges very widely depending on user size, location and other factors. The reader is directed to the Eskom Tariff booklet as well as the various supply authorities' tariffs for additional information.

A lot of building owners are also not aware that their original electrical connection can be reduced there by saving money and making infrastructure capacity available to the supply authority. For Buildings with an Eskom account the notified maximum demand (NMD) is typically stated on the account. On municipal accounts an enquiry with the local supply authority is typically required to obtain the NMD.

Typically energy consumption is either charged at a flat rate or according to a "time-of-use" charge which vary the rate based on the time of day/year the energy is consumed. Whilst peak demand (or maximum demand) is typically charged a flat or variable rate for each unit of apparent power consumed based on the highest apparent power demand in the billing period. Note that demand is monitored over defined intervals (integrating period) of typically 30 minutes to calculate the maximum demand billed amount.

Generally three basic strategies can be employed to reduce the peak demand of a facility:

- Load shifting
- Power factor correction
- Energy efficiency initiatives
- Adding renewable energy sources (photovoltaic, wind, etc.)

Load shifting

Load shifting involves scheduling high demand processes not to operate at the same time thus reducing the overall peak demand of the site. Processes can also be shifted to operate during periods in which peak demand charges do not apply, however factors such as overtime costs must be kept in mind. Additional examples which exploit thermal energy storage to reduce and shift electrical demand include:

- Ice storage air-condition systems
- Pre-cooling buildings using the cooler night time /early morning air
- Heat storage in tanks, rock caverns, concrete of pebbles

Power factor correction

Power factor is the relationship between real and apparent power. It is a measure of the efficiency of an electrical system in converting electrical power to useful forms of work. The larger the difference between the apparent power (measure in kVA) and the real power (measured on kW), the lower the site's power factor at any instant in time will be, resulting in higher peak demand charges. Note that the power factor at peak demand is of concern, as a low power factor at low demand will not have an impact on demand charges.

Power factor correction is a widely accepted technology that can be used to reduce the peak demand of a site. Typically a large bank of capacitors is used to reduce the difference between the real and apparent power used.

Energy efficiency initiatives

Energy efficiency improvement initiative can have a significant impact on peak demand. However it is possible to reduce the amount of energy consumed without impacting on peak demand. This can be attributed to the fact that peak demand is calculated over an integration period and should be kept in mind when considering energy saving initiatives.

Additional guidance on how excess network access charges are calculated the reader is directed to Eskom tariff booklet which can be downloaded from the Eskom webpage http://www.eskom.co.za/

The effects of peak demand shifting, or load shifting, is illustrated in the figures below.

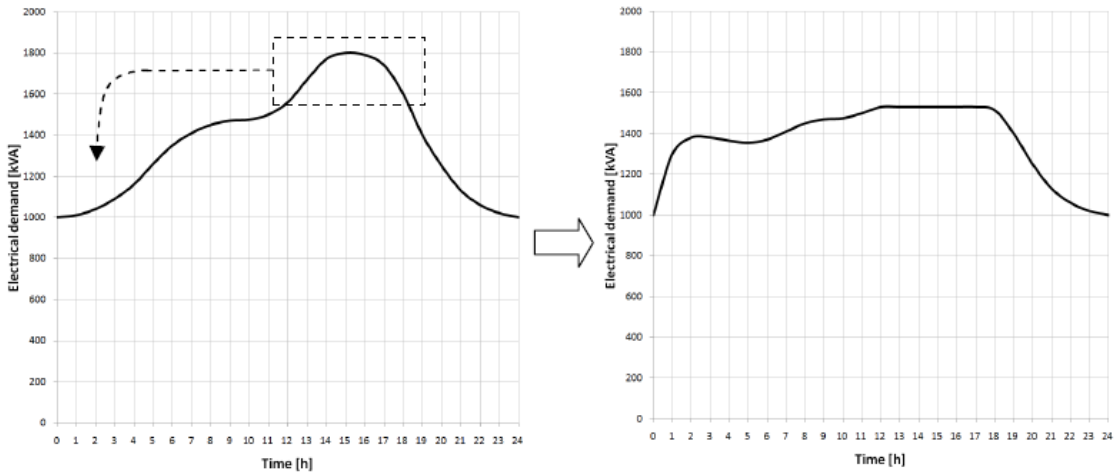


Figure 2. Graphs indicating how the peak demand can be shifted into another period of the day to result in a deduced overall peak.

The figure below illustrates the difference in average peak demand and maximum peak demand. The difference between these two parameters should be as small as possible.

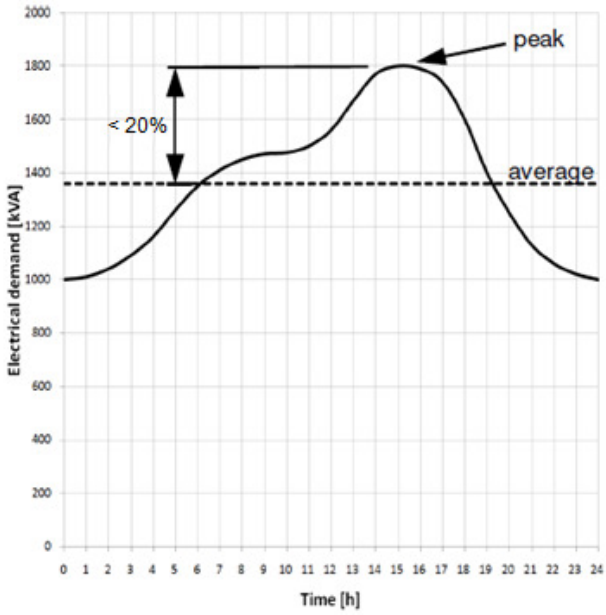


Figure 3. Graph indicating the percentage difference between the peak and the average of the annual demand curve

SANS Benchmarks

The following benchmark maximum energy demand values are specified by the SANS 10400-XA: 2011 document.

Table 2. Maximum energy demand per building classification for each climatic zone (1)

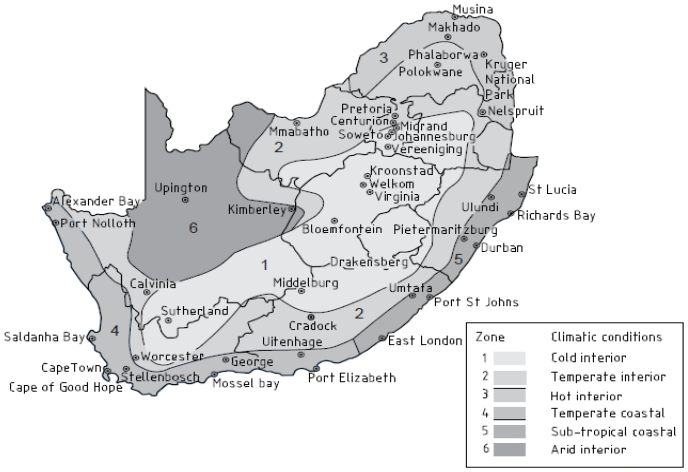
1	2	3	4	5	6	7	8
Classification of occupancy of building	**Description of building**	**Maximum energy demand[a]** VA/m²					
		Climatic zone					
		1	**2**	**3**	**4**	**5**	**6**
A1	Entertainment and public assembly	85	80	90	80	80	85
A2	Theatrical and indoor sport	85	80	90	80	80	85
A3	Places of instruction	80	75	85	75	75	80
A4	Worship	80	75	85	75	75	80
F1	Large shop	90	85	95	85	85	90
G1	Offices	80	75	85	75	75	80
H1	Hotel	90	85	95	85	85	90

[a] The maximum demand shall be based on the sum of 12 consecutive monthly maximum demand values per area divided by 12/m², which refers to the nett floor area.

The climatic zones for South Africa are shown in the figure below.

EB-ENE-2 Peak Electricity Demand

POINTS AVAILABLE **2**



Zone	Description	Major centre
1	Cold interior	Johannesburg, Bloemfontein
2	Temperate interior	Pretoria, Polokwane
3	Hot interior	Makhado, Nelspruit
4	Temperate coastal	Cape Town, Port Elizabeth
5	Sub-tropical coastal	East London, Durban, Richards Bay
6	Arid interior	Upington, Kimberley

Figure 4. Climatic Zone reference chart (1)

BACKGROUND

Peak demand is a primary issue of concern for electricity supply networks, as it is a direct driver of network capacity requirements. In contrast to the variable nature of electricity demand, network capacity cannot be increased in the short-run to accommodate excessive periods of demand.

Generally there are two types of peak periods that exist – wholesale network peak demand and localised distribution network peak demand. Wholesale network peaks generally occur towards the mid-afternoon, driven by aggregate commercial activity; whereas local distribution network peaks (generally in residential areas) are often later in the afternoon or evening as people return home from school and work (Productivity Commission). At present Eskom experiences peak demand between 5pm and 9pm. .

Electricity tariffs and charges – financial incentive to monitor

Building electricity accounts are normally made up of three components:

- Max demand (kVA) (Peak electricity demand)
- Actual usage (kWh)
- Connection size levy

Accurate monitoring and metering of utilities will enable building owners to make informed decisions regarding tariff plans (e.g. reduced rates after peak hours, awareness of max demand penalties, etc.).

Historical data analysis can also lead to the realisation that legacy electrical connection sizes are excessive and savings can be achieved by reducing the connection size.

Impact of Credit SA market:
In light of the increased demand on South Africa's electrical supply, Demand-side Management (DSM) and energy efficiency projects are currently being implemented by Energy Service Companies (ESCOS) to achieve electrical savings and obtain rebate payments from Eskom.

The metering installation forms a critical part of the measurement and verification process to quantify for rebates and determine the effectiveness of the DSM project. To this end, compliance with Eskom's PM/M&V/STD001 (currently under review) metering standard should be considered when selecting the metering standard and methodology for the building(s).

REFERENCES

1. **SOUTH AFRICAN NATIONAL STANDARD.** *SANS 10400-XA:2011 The application of the National Building Regulations, Part X: Environmental sustainability, Part XA: Energy usage in buildings.* Pretoria : SABS Standards Division, 2011.
2. *SANS 204:2011 Energy efficiency in buildings.* Pretoria : SABS Standards Devision , 2011.
3. **Green Star Australia.** Green Star - Performance . Sydney : s.n., 2013.

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

EB-TRA-1 Alternative Transportation

POINTS AVAILABLE **4**

AIM OF CREDIT

To measure and assess transportation modes of regular building occupants and promote/encourage green travel plans for commuting and as a result reduce pollution and land development impacts from automobile use.

CREDIT CRITERIA

Transportation Modes Survey	1 point is awarded where a Transportation Modes Survey, aimed at the regular occupants of the building(s), is delivered during the performance period. Transient occupants/visitors must be surveyed if either the typical visitor peak or daily average is greater than the number of regular building occupants.
Green Travel Plan (GTP) – Regular Occupants and Visitors	2 points are awarded where a Green Travel Plan (GTP) that addresses regular occupants of the project building(s), is in place and operational during the performance period. Transient occupants/visitors must be included in the plan if either the typical visitor peak or daily average is greater than the number of regular building occupants.
Improved Transportation Modes Performance: Improvements on Baseline	1 additional point is awarded where there has been a follow-up Transportation Modes Survey Conducted which shows at least 10% reduction in single occupant car drivers (against the first survey taken). For projects undertaking Existing Building Performance Certification for the first time, the additional point can be claimed as Not Applicable. Type 'na' in the 'points achieved' column of the rating tool.

TRANSPORTATION MODES SURVEY

Develop and carry out a transportation modes survey of all regular building occupants and, if applicable, all transient occupants/visitors to the project building(s). This transportation modes survey must be carried out during the performance period, and should be carried out early on in the certification process, preferably at the beginning of the performance period.

The survey must represent a **typical** one-week period within the performance period. Where applicable to the building use, this one-week period cannot include holidays or other days/times of the year which may not represent a typical occupancy period for the particular building type. While the survey can be taken on a single day, the survey must be structured in a way that respondents can provide detail of their commute pattern over the full week period and must provide the opportunity for qualitative answers to allow respondents to provide input into a site-appropriate Green Travel Plan.

A sample questionnaire is provided below, and projects are encouraged to use it. However, where an organization has carried out a survey meeting these requirements at some point over two years

immediately preceding the submission for Green Star SA certification, the results may be submitted as evidence to comply with the requirements of this credit. Where a project building is located on a campus or within an office park and a campus-wide/business park survey is carried out, this may be used as proxy for the response results for a specific building on that campus.

Population

The population size for number of regular occupants should be the maximum number of occupants that will regularly work at the premises (Full Time Equivalent (FTE) employees) during the performance period. Population sizes can be estimated where there is no access to more precise figures, by using typical occupancy per meter square.

The population size for visitors shall be the typical number of visitors for the day being surveyed.

Sample Size

The surveyed sample size must be such that it provides 95% confidence with a 10% margin of error. The table below shows acceptable sample sizes in this regard.

If the required sample size for 10% margin of error is not achieved, the number of additional respondents required to reach the correct sample size should be assumed to make use of single occupancy cars, and be added to the actual surveyed respondents.

Table TRA-1.1: Sample Size determination

Survey Responses needed for 95% Confidence	
Population Size	**Responses Needed for 10% Margin of Error(Sample Size)**
>100	**75%**
100	**51**
150	**61**
200	**67**
250	**72**
300	**76**
350	**78**
400	**81**
450	**82**
500	**83**
700	**88**
900	**90**
1000	**91**
2000	**95**
5000	**98**
10000	**99**
20000	**100**

Table TRA-1.2: Sample Survey Results Template

Transport Mode	Monday		Tuesday		Wednesday		Thursday		Friday		Total
	am	pm	am	pm	am	pm	am	pm	am	pm	
Single occupancy vehicle											
2 person carpool											
3 person carpool											
4 person carpool											
Walking											
Cycling											
Bus											
Minibus Taxi											
Train											
Dropped off/collected by partner/neighbor											
Sick day											
Work from home day (telecommuting)											
Teleconferencing											
Other											
Total											

GREEN TRAVEL PLAN FOR REGULAR OCCUPANTS & / OR VISITORS

N.B. Although it is not necessary for organizations seeking certification to develop separate plans and programmes, projects are required to highlight - and where not present in existing plans and programmes, amend these to include - all elements of the Green Star SA Policy and Programme/Plan Model as well as the recommended elements to be included, outlined below.

Develop and implement a Green Travel Plan (GTP) that is specifically tailored to the project building(s) and its/their location.

'Green Transport', for the purposes of this credit, relates to transport modes that assist in reducing the environmental impacts from conventional single-occupant vehicles used for commuting. More specifically and typically, 'conventional single-occupant vehicles' are petrol or diesel powered automobiles that are used by one single individual for commuting. For the purposes of this credit, a programme that facilitates, promotes and encourages the use of alternative transport as defined above is known as a 'Green Travel Plan.

Although there are no 'standard' Green Travel Plans or programmes in South Africa, since the design and implementation of such a programme depends largely on the nature, location and size of the project building(s) and the outcomes that project buildings are looking to achieve, there are numerous references in the literature that provide examples of leading practice for alternative transportation options and schemes. (see References). A **Menu of Options** for addressing and/or encouraging alternative green transportation modes is included under Additional Guidance/Resources.

Improved Transportation Modes Performance: Improvements on Baseline

Once a GTP has been developed and implemented, repeat transport surveys, following the same methodology as outlined under Transportation Modes Survey above, can be carried out to assess the efficiency and effectiveness of the GTP. Projects who can demonstrate a 10% reduction in single occupant car drivers are rewarded with an additional point.

EB-TRA-1 Alternative Transportation

POINTS AVAILABLE **4**

DOCUMENTATION REQUIREMENTS

Submit all evidence and ensure it readily confirms compliance; also complete submission template/check list.

Credit	Documentation Requirements/Evidence
All	• **Completed Submission Template**
Transportation Modes Survey and Improved Transportation Modes Performance	• **Copy of the survey questionnaire.** • **Summary of Survey Results** • **Repeat Survey Results** (additional point)
Green Travel Plan – Regular Occupants and Visitors	• **Copy of the Green Travel Plan**

ADDITIONAL GUIDANCE / RESOURCES

Alternative Modes of Transportation

When developing the Green Travel Plan, this should specifically include the following

- **Describe current status**

  Describe the status quo of commuter transport to and from the project building(s) and review any existing and planned public transport options available to commuters as well as their current usage (survey results)

- **Define Strategy for at least 3 Alternative Transport Options**

  Formulate a clear outline of the strategies and performance metrics that actively support at a minimum three “Transport Options” from the menu of options of the Alternative Transportation Programmes below.

- **Target GTP at regular occupants & / or visitors**

  Ensure that the GTP is targeted at regular building occupants. Where the typical peak or daily average of transient occupants/visitors is greater than the number of regular building occupants, the GTP must also target transient occupants/visitors.

- **Communications strategy to regular occupants & / or visitors**

  Outline the communications strategy to be employed to ensure that the GTP is adequately communicated to regular building occupants and visitors/transient occupants to ensure that the GTP remains effective.

- **Set timelines for Implementation**

Set clear time-lines for the implementation of the GTP and communication strategies

EB-TRA-1 Alternative Transportation

POINTS AVAILABLE **4**

Providing the most appropriate systems and incentives to building users that will encourage the use of alternative transportation modes is paramount to reducing overall environmental, social and economic impacts of transporting users to and from buildings. The following sections provide a menu of options that projects must choose from when developing an Alternative Transportation Programme.

Person powered transport		
TRANSPORT OPTIONS	**RESPONSES/INCENTIVES WITHIN BUILDING OWNER CONTROL**	**SCHEMES/INCENTIVES NOT WITHIN BUILDING OWNER CONTROL**
• **Bicycling and group Bicycling**	Company bicycles Secure storage with air pumps Changing and showing facilities Guaranteed Ride Home Facilities On site services, e.g. ATMs and restaurants	Public bicycles Bicycle lanes/shared pavements Marshalls Bicycling Social Clubs Promotion Drives
• **Walking and group walking**	Onsite services, e.g. ATMs, restaurants Changing and showering Facilities On site services, e.g. ATMs and restaurants	Safe, well lit pavements and crossings Water facilities (drinking fountains) along routes Marshalls Walking Social Clubs Promotion Drives

EB-TRA-1 Alternative Transportation

POINTS AVAILABLE **4**

Individual Motorised Transport

TRANSPORT OPTIONS	RESPONSES/INCENTIVES, WITHIN BUILDING OWNER CONTROL	SCHEMES/INCENTIVES NOT WITHIN BUILDING OWNER CONTROL
• Fuel efficient vehicles • Hybrid vehicles • Motor bikes	Preferential Parking Bays: free parking, paid for parking Online support tools and subsidies	• **Social Drives to Promote Use** • **Decreased Road Tax** • **Driver Incentives (lower vehicle carbon tax)**
• Electric vehicles	Preferential Parking Bays: free parking, paid for parking Online support tools and subsidies Electric fuelling stations	

Multi-Occupant Motorised Transport

TRANSPORT OPTIONS	RESPONSES/INCENTIVES, WITHIN BUILDING OWNER CONTROL	SCHEMES/INCENTIVES NOT WITHIN BUILDING OWNER CONTROL
• Car Pools • Van Pools	• Preferential Parking Bays: free parking, Online support tools and subsidies • Paid-for parking	• Social Drives to Promote Use • Availability of public car share schemes
• Car share • Zip Cars	Company supported car share schemes Onsite preferential parking and easy access Online support tools and subsidies and ease of booking	

EB-TRA-1 Alternative Transportation

POINTS AVAILABLE **4**

Public Transport		
TRANSPORT OPTIONS	**RESPONSES/INCENTIVES, WITHIN BUILDING OWNER CONTROL**	**SCHEMES/INCENTIVES NOT WITHIN BUILDING OWNER CONTROL**
• Minibus Taxis • Busses • BRT • Trains • Company Shuttles • Other: e.g. Tuk-Tuks	• Subsidies and Bus/Train Passes especially regular commuters • Online support portal for time tables • Free or affordable shuttle services to public transport hubs/stations >500m Secure minibus taxi stops/shuttle drop-offs close to building entrance(s) walking distance	•**Social Drives to Promote Use** •**Private/public transport integration** •**Link into and support of multi-modal transport hubs**

BACKGROUND

Environmental Impacts of Transportation

In 2007, transport fuels in South Africa made up 30% of energy consumption (by energy content) and 70% by value (Biofuels Industrial Strategy, DME, 2007). Direct emissions from motor vehicles contribute to smog and other forms of air pollution: in 2000, global emissions as a result of transport-related activities were estimated to account for around 20% of all greenhouse gas (GHG) emissions caused by human activities (WBCSD, 2004). Other studies suggest that by 2006, worldwide CO2 emissions from fuel combustion generated by the transport sector, including light duty vehicles amounted to 33% (AC-WEC, 2009), with predictions, however, that the transport sector would rise about 40% between 2006 and 2030 (OECD 2008), with greenhouse gas emissions from transport increasing at a faster rate than any other energy using sector (Kahn et al 2007).

Research dating back to 2003 suggests that the shift from private to public modes of transportation can have significant impacts on reducing overall emissions levels associated with transport: measured in 'passenger mile travelled' a 95% reduction in carbon monoxide, 92% reduction in Volatile Organic Compounds and an almost 50% reduction in carbon dioxide and nitrogen oxides can be achieved. (APTA 2003).

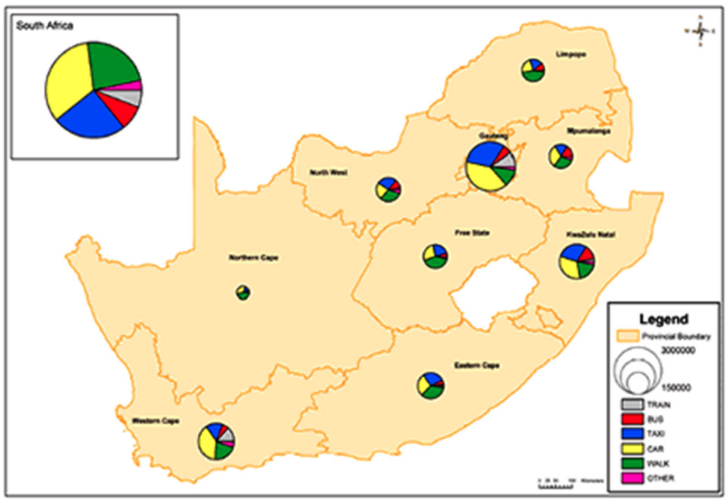
State of Public Transport in South Africa

The 2003 National Household Travel Survey (released 2005) showed that almost two-thirds of households in South Africa did not have access to public transport. Figures show that at the time there were approximately 3.9m public transport commuters: 2.5m taxi commuters (63%), 0.86m bus commuters (22%) and the remainder (0.6m – 15%) using train services. More than 300 000 commuters also used taxis as a feeder mode to other public transport services. On aggregate, taxis provided close to 70% of all public transport trips in South Africa. While the statistics will have shifted since the 2003 survey, the figures regardless provide a good indication on the prevailing complexities and challenges of public transport provisions in South Africa.

The social and economic strains that an underdeveloped, while at the same time expensive public transport system, poses also express themselves in the fact that in 2003 30% of households spent

more than 10% of household income on public transport. The average travel time (per trip) by commuters (all modes) was 43 minutes, increasing to 59 minutes for public transport, where around 1.3m commuters using public transport spent more than an hour per trip to work. Walking distances to public transport services in urban and rural areas alike also indicate serious challenges, by far exceeding targets of 15 min walking distance (urban areas) and 30 min walking distances (rural areas) to bus, train and taxi services.

Crucially, the public transport share of all motorised trips is 52%, which is high by world standards (ca. 53%). Maintaining or further increasing this share is a challenge, especially when coupled with rapid growth in car ownership. For a country with a relatively low average household income, South Africa has a high rate of car ownership: in 2003, for every 1000 people, there were 109 cars owned (Lagos: 15/1000, Nairobi: 50/1000 and New York: 500/1000). (Satawu 2006).



The above figure (DoT 2005) shows transport modes used for travel to work in each province based on the 2003 National Household Travel Survey. More recent figures, once available, can be used to establish provincial benchmarks for modes of transport to and from work to allow national and provincial benchmarking for building projects.

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TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

EB-WAT-1 Potable Water

POINTS AVAILABLE **12**

AIM OF CREDIT

To recognise efficient potable water use associated with building operations thus reducing the burden on potable water supply and wastewater systems.

CREDIT CRITERIA

Potable Water Performance	A total of 12 points may be awarded for percentage improvements in water efficiency compared to benchmarks or historical performance. In addition to points achieved above, where the full 12 points are not achieved: A further 1 point is awarded where there is proven water saving during 6 consecutive months of the performance period compared to same period in the previous year. A further 1 point is awarded where this water saving exceeds 10%.

Performance period
Performance period relates to the continuous time period during which a credit is measured or data is collected. For Green Star SA – Existing Building Performance certification, the performance period is the most recent 12-month period of operations preceding the submission for certification.

The end of the performance period data set should not be older than 3 months at the time of submission.

Note: The energy and water data need not be from the exact same period, provided the point above applies.

Collect metered water consumption data for the last 12 months of the building's operation.
Water consumption data for the past 12 months must have been collected in order to demonstrate compliance with the credit criteria. This data will be used to measure against benchmarks and quantify improvements in water consumption efficiency, for which points will be awarded as described in the compliance paths.

Sources of acceptable data

- Water consumption data collected for the building must be verifiable with sources such as Municipal accounts, or
- Metering data signed off by independent metering contractor, or
- Metering data signed off by Facilities Manager if monitored in-house

Collected water data must cover the water use associated with the whole building. If there are any missing accounts or data points, the missing data point may be interpolated for completeness, using the average of the known information except when the missing data point is the first one or the last one of a series. A maximum of 3 months in the 12 month period may be interpolated.

Water use must include all building water consumption; this could include but not be limited to:

- Occupant amenity water (toilets, kitchenettes, etc.)
- Heat rejection water (cooling towers / evaporative cooling)
- Outdoor taps, wash-down areas, etc.
- Tenant consumption (restaurant kitchens etc.)
- Irrigation of landscaping serving the building being certified
- Pools, water features, etc. servicing the building
- Sports field irrigation only if the building being certified services the said sportsfield

'Water' refers to potable water servicing the building from municipal sources. Recycled / reused water and rainwater must not be included in the metered water consumption for this credit. Borehole Water used for anything other than irrigation is not considered to be a sustainable water source for the purposes of this credit and as such it must be included in the metered water consumption.

Municipal Accounts
Data from utility accounts (as opposed to metered data) will only be accepted if no more than 3 months of data in the 12 month period is estimated.

Compliance Paths
For the purposes of this credit, there are four options for establishing a water consumption benchmark for the building as outlined below.

Note that only one compliance path may be followed.

COMPLIANCE PATH 1: GBCSA 'EWP' WATER BENCHMARKING TOOL (OFFICE BUILDINGS)

EWP is the GBCSA's Energy & Water Benchmarking Tool which can be accessed on the GBCSA's website (https://www.gbcsa.org.za/other-tools/energy-water-benchmark/).

If the GBCSA's EWP Tool caters for your building type (currently caters for office buildings), this tool must be used to benchmark your building's performance.

The building is positioned on a 10 level scale based on its performance relative to the benchmark. The level achieved in the benchmarking tool is then translated into the number of points scored under this credit (out of 12).

The output from in the "water results" tab of the EWP Tool will indicate the number of points achieved.

If the building is part of an office park or precinct and its landscape is irrigated through a shared irrigation system, then the water consumption portion for the irrigation can be adjusted on a pro rata basis according to the GLA of the building compared to the total GLA off all buildings part of the office park. If an alternative approach to apportionment is proposed, this must be submitted as an alternative for approval to the GBCSA prior to submission for certification.

To summarise, for Compliance Path 1, the following procedure must be followed:

1. Collect 12 months of water consumption data
2. Benchmark office building using the EWP Tool (ensure that detailed inputs are completed, accounting for vacancy)

EB-WAT-1 Potable Water

POINTS AVAILABLE **12**

Compliance Path 1 Resources:

Resource	Description	Location
EWP Tool	Use to benchmark building performance	http://www.gbcsa.org.za/other-tools/energy-water-benchmark/
EWP Guidelines	Provide details on how to use benchmarking tool	http://www.gbcsa.org.za/other-tools/energy-water-benchmark/

COMPLIANCE PATH 1 POINTS:

Points are awarded from a EWP score of 5 and up. The table below illustrates how points are awarded based on % improvement on a EWP score of 5.5.

% Improvement over EWP score 5.5	WAT-1 Points
-12,0%	0,5
-7,1%	1
-2,3%	1,5
2,6%	2
7,5%	2,5
12,3%	3
17,2%	3,5
22,1%	4
26,9%	4,5
31,8%	5
36,7%	5,5
41,5%	6
46,4%	6,5
51,2%	7
56,1%	7,5
61,0%	8
65,8%	8,5
70,7%	9
75,6%	9,5
80,4%	10
85,3%	10,5
90,2%	11
95,0%	11,5
100,0%	12

COMPLIANCE PATH 2: COMPARABLE BUILDINGS
(For building types NOT covered by the EWP tool)

Not all building-types are covered by the EWP tool. As such, these premises can still be eligible for points under this credit by following the point scoring path as described below.

Water consumption baseline from data collected from comparable buildings
A water consumption baseline must be determined from historical data of at least two (2) other comparable buildings. Historical data from at least one (1) recent year period shall be used for the calculations.

The water performance benchmark determined using this option, will represent the 'average performer' against which the premises seeking Green Star certification will be compared. Percentage differences will then be calculated in increments as per the table below to allow for improvements to be measured.

Percentage better than 'average performer'	Compliance Path 2, 3 and 4
0%	0,5
2,5%	1
5%	1,5
7,5%	2
10%	2,5
12,5%	3
15%	3,5
20%	4
25%	4,5
30%	5
35%	5,5
40%	6
45%	6,5
50%	7
55%	7,5
60%	8
65%	8,5
70%	9
75%	9,5
80%	10
85%	10,5
90%	11
95%	11,5
100%	12

For Compliance Path 2, the following process must be followed

1. Determine if the buildings being used to create the baseline are of 'comparable use' to the premises seeking Green Star certification as per guidelines provided here. See checklist below.
2. Collect historical monthly water data, from 12 months covering the major water sources used by the comparable buildings as well as 12 months of data for the building being rated;
3. Collect 'Water Variance Factor' info (see below) for all buildings and ensure comparable between buildings or suitably normalised (complete checklists in submission template and fulfil documentation requirements);
4. Use the Green Star SA – Existing Building Performance Water Calculator* to benchmark the building seeking certification against the 2 comparable buildings.

The data collected as part of this process will be used to determine a simplified average water consumption performance baseline.

Determining comparable buildings

Comparable buildings are defined as buildings in the same climatic zone that have the same primary use and that have similar operating characteristics.

This means that if the primary use of the building under investigation is defined as a "Restaurant", the primary use of the buildings used in the comparison must also be "Restaurant". Primary use is defined as at least 70% of the Gross Lettable Area (GLA) of a building having the same use. Where buildings are characterised by mixed-use if no single primary use covers 70% of the GLA an area weighted approach may be used (see 'Mixed Use Buildings' after Compliance Path 4 resources).

Comparable buildings shall be defined in terms of the following variables:

1. Type of building (same)
2. Use of building (same)
3. Climatic zone (same)
4. Hours of operation (within 15%, or normalised)
5. Occupation rate (e.g. m2/person) (within 15%, or normalised)
6. HVAC systems (Water Cooled vs Air Cooled) (same)
7. Irrigated Area (less than 20% of GLA, or more than 20% of GLA)
8. Vacancy Rate (within 10% of total occupation %)

Overleaf is a table extracted from the Submission Template which must be completed in order to demonstrate that the buildings are in fact 'comparable'.

EB-WAT-1 Potable Water

POINTS AVAILABLE **12**

Table 1: Variance Factors for Comparable Buildings (to be completed in Submission Template)

Water Variance Factor	Do 'comparable buildings' align with respect to the following variance factors?		If no, has a suitably qualified professional applied appropriate normalising to the benchmark in this regard?	
	Y	N	Y	N
Building Usage (E.g. Retail)			N/A	
Hours of operation (within 15%)				
Occupant density (within 15%) e.g. m2 per person.				
Vacancy rate (%) within 10% of total occupation %. I.e. 10% and 20% vacancy considered comparable.				
Specific Influence Space Types (e.g. Gyms, Laundries, etc.)				
Ambient conditions (within same climate zone)			N/A	
HVAC system (water cooled / air cooled)				
Other: (specify)				

Note that to be deemed 'comparable', each of the energy factors listed above must either align for the comparable building and actual building, or must be normalized for.

Methods of Normalising

Based on the table above, should any normalising be required for the 'comparable building' baseline, such normalising must be conducted by a suitably qualified professional (Mechanical Engineer or Technician with min 3 years relevant experience in Water benchmarking, or a Measurement & Verification (M&V) professional). A guideline of a suggested simplified normalising methodology is provided under 'Additional Guidance'.

Collecting area information

Gross Lettable Area (GLA) or Gross Floor Area (GFA) data must be collected from comparable buildings to allow for the establishment of the baseline. This data must be presented in square metres and be verifiable from floor plans or measurements obtained from site.

The GLA/GFA will be required to "normalise" the collected water data to a kl/m^2/annum. For building types where area may not be the most sensible means of comparing water performance, applicants may motivate alternative comparison approaches for approval via Credit Interpretation Request (CIR). For example in Healthcare it may be water consumption per bed.

Collecting hours of operation

The 'hours of operation' of a building is an important variable in determining the baseline that can be used for comparisons. 'Hours of operation' means the total number of hours a week a building is fully capable of being used for its main purpose.

The building under investigation is to be used as the point of reference for this comparison. This means that if the building under investigation typically operates Monday to Friday from 8am to 6pm (50 hours a week), the hours of operation of the comparable buildings in comparison group should also ideally operate in the vicinity 50 hours a week.

It is understood that the comparison building may not have the exact same 'hours of operation'. Where hours of operation vary significantly, these can be normalised for.

Climate zones
To mitigate against the influence of different climate and weather conditions that may influence a building's water use such as irrigation and evaporation rates, only comparable buildings from the same climate zone as defined by SANS 204 and 10400-XA shall be used for comparison. If the building does not have irrigation or evaporative condensers / cooling towers, this item is not applicable and climatic influence can be assumed to be adequately accounted for.

Other operational characteristics
Variables that could explain how water is consumed by building operations must also be collected for all buildings and shown to be comparable (as detailed above).

Where the specific building type may have an operational characteristic not listed above which is likely to affect energy performance significantly, this should be collected and shown to be comparable between the Comparable buildings, or be shown to be adequately normalized for.

To summarise, for Compliance Path 2, the following procedure must be followed:

1. Identify 2 'comparable buildings' (as per guidelines provided here and in the Water Calculator)
2. Collect water consumption and other required data for 2 buildings as well as the building being certified
3. Use the Green Star SA – Existing Building Performance Water Calculator to benchmark the building seeking certification against the 2 comparable buildings.

Compliance Path 2 Resources:

Resource	Description	Location
Existing Building Performance Water Calculator	Use to benchmark building seeking certification against 2 comparable buildings and to determine final score for this credit	www.certificationengine.org

COMPLIANCE PATH 3: HISTORICAL DATA

(For premises NOT covered by the EWP Tool or Industry benchmarks, and where no comparable building data is available)

Historical data from a baseline year that occurred within the last ten (10) years can be selected by the Applicant as baseline for the building. The data from the selected year will present the 'average performance' for the particular premises. The performance period data will then be evaluated against the average performer.

The process as described in Compliance Route 2 above to collect data shall also be followed for Compliance Path 4.

Demonstrating Validity of Baseline

Below is a table extracted from the Submission Template which must be completed in order to demonstrate that the baseline year selected is in fact representative for benchmarking.

Table 2: Changes in Water Variance Factors (to be completed in Submission Template)

2. Complete 'Validity of Baseline Checklist' Below				
Water Variance Factor	**Have any of the following factors changed significantly since the Historical Baseline Period?**		**If yes, has a suitably qualified professional applied appropriate normalising to the baseline in this regard?**	
	Y	**N**	**Y**	**N**
Building Usage (E.g. Community Retail Centre)			N/A	
Hours of operation (within 15%)				
Occupant density (within 15%) e.g. m2 per person.				
Vacancy rate (%) within 10% of total occupation %. I.e. 10% and 20% vacancy considered comparable.				
Other: (specify)				

Note that to be deemed a representative baseline year, each of the energy factors listed above must either align between the baseline year and the performance period, or must be normalized for.

Methods of Normalising

Based on the table above, should any normalising be required for the 'comparable building' baseline, such normalising must be conducted by a suitably qualified professional (Mechanical Engineer or Technician with min 3 years relevant experience in Water benchmarking, or a Measurement & Verification (M&V) professional). A guideline of a suggested simplified normalising methodology is provided under 'Additional Guidance'.

To summarise, for Compliance Path 3, the following process must be followed

1. Collect historical water consumption data for the building

2. Use the Green Star SA – Existing Building Performance Water Calculator* to benchmark the building against its own historical performance.

Compliance Path 3 Resources:

Resource	Description	Location
Existing Building Performance Water Calculator	Use to benchmark building seeking certification against its own historical baseline and to determine final score for this credit	www.certificationengine.org

COMPLIANCE PATH 4: INDUSTRY BENCHMARKS

Where the GBCSA's 'EWP' Energy Benchmarking Tool does not cater for your building type, and no comparable building data or historical data is available, applicants can motivate a suitable industry benchmark for use to rate their building. (E.g. surveyed data from industry bodies, etc.)

Approved Benchmarks:
The GBCSA will also publish in this credit, industry benchmarks which have been approved for use in Compliance Path 4 as these are permitted for existing building projects. At this time, the following benchmarks are considered appropriate for application in this compliance path:

- **Investment Property Databank (IPD) South Africa Water Efficiency Benchmarks** where applicable

Whether using one of the benchmarks above or motivating a new benchmark, projects are required to complete the 'Benchmark Motivation Checklist' in the submission template (Table 3 and 4 below).

MOTIVATING A BENCHMARK

There are primarily three types of benchmarks which could be put forward for your building type, namely

- **Benchmarks based on statistical data**
- **Benchmarks based on calculated or simulated performance**
- **Published National / International Standards**

These are listed in the 'Benchmark Motivation Checklist' below (extracted from the Submission Template) along with the requirements for using either of these benchmark types.

Table 3: Benchmark Motivation Checklist (to be completed in Submission Template)

BENCHMARK BASED ON STATISTICAL DATA OR PUBLISHED STANDARDS:			
Benchmark Used (Version, Release date, Author, etc.)			
Requirements	**YES**	**NO**	**Comment**
Is this an appropriate benchmark for the building?			
Has the benchmark been independently developed (independent from the building owner company) by a credible third party institution?			
Are the sample buildings of the same usage type to the building seeking certification?			
Does benchmark adequately take into account water variance factors (as set out in Table 4 overleaf), or are these factors adequately normalised for?			
BENCHMARK BASED ON CALCULATED OR SIMULATED PERFORMANCE:			
Benchmark Used (Version, Release date, Author, etc.)			
Requirements	**YES**	**NO**	**Comment**
Is this an appropriate benchmark for the building?			
Is the benchmark appropriate to the usage type of the building seeking certification?			
Does the benchmark adequately take into account water variance factors within the calculation inputs and methodology (as set out in Table 4 overleaf) or are these adequately normalised for?			

NORMALISING THE BENCHMARK

As a general guide, the following variance factors must be taken into account by the chosen Benchmark where applicable.

Table 4: Variance Factors & Normalising (to be completed in Submission Template)

Water Variance Factor	Does benchmark adequately account for the impact of this factor? If yes, state how.			If no, has a suitably qualified professional applied appropriate normalising to the benchmark in this regard?	
	Y	N	Comment	Y	N
Building size (GLA and Net Floor Area)					
Hours of operation					
Occupant density (e.g. m2 per occupant)					
Vacancy rate (%)					
Number of beds (Hospitals, Hotels, Dormitories, etc.)					
Specific Influence Space Types (e.g. Gyms, Laundries, etc.)					
Ambient conditions (location)					
HVAC system (air cooled / water cooled)					
Irrigated Area (amount of irrigation usage)					
Other: (specify)					

Note that to be deemed an appropriate benchmark, each of the water factors listed above must be adequately accounted for in the benchmark, or must be normalized for.

Methods of Normalising

Based on the table above, should any normalising be required for the benchmark chosen, such normalising must be conducted by a suitably qualified professional (Mechanical / Electrical Engineer or Technician with min 3 years relevant experience in Water benchmarking, or a Measurement & Verification (M&V) professional). A guideline of a suggested simplified normalising methodology is provided under 'Additional Guidance'.

To summarise, for *Compliance Path 4*, the following procedure must be followed:

1. Collect 12 months of energy consumption data

2. Source a suitable Industry Benchmark for the building, ensuring it is appropriate and normalised if required (complete checklists in submission template and fulfil documentation requirements)

3. Benchmark building against Industry benchmark using the Water Calculator

Compliance Path 4 resources:

Resource	Description	Location
Existing Building Performance Water Calculator	Use to benchmark energy consumption against Industry benchmarks and to determine final score for this credit	www.certificationengine.org

MIXED-USE BUILDINGS

The following methodology for mixed-use buildings (including sites or developments) shall apply to Compliance Paths 1 & 2:

- If 70% or more of a building's GLA comprises a single space type, the building's space use shall be defined by this type. If the building consist of more than one space type and no single space type is more than 70% of the GLA, then the relevant compliance path shall be used to rate each space type separately. The final score shall be a pro rata averaged based on the respective scores and floor areas.

  If a space type makes up less than 10% of the building's GLA, it can be excluded (both consumption and GLA) from the benchmarking calculation provided the sum of all excluded areas do not exceed 10% of the building GLA.

- Example 1: If the building comprises 90% Retail and 10% Office space, the primary use of the building shall be Retail.

- Example 2: If the building under investigation consists of 60% Office, 35% Retail and 5% residential - The office and retail components shall be benchmarked separately using the most appropriate compliance paths. The residential water consumption and floor area can be excluded from benchmarking exercise. The final score shall be calculated by adding the final scores for each space type averaged based on floor area of each space type.

EB-WAT-1 Potable Water

POINTS AVAILABLE **12**

POINTS SCORING:

Table 5: Scoring Table – Compliance paths 2-4

Percentage better than 'average performer'	Compliance Path 2, 3 and 4
0%	0,5
2,5%	1
5%	1,5
7,5%	2
10%	2,5
12,5%	3
15%	3,5
20%	4
25%	4,5
30%	5
35%	5,5
40%	6
45%	6,5
50%	7
55%	7,5
60%	8
65%	8,5
70%	9
75%	9,5
80%	10
85%	10,5
90%	11
95%	11,5
100%	12

ADDITIONAL POINTS - WATER SAVING OVER PERFORMANCE PERIOD

1 point is awarded where there is proven water savings for a 6 month period during the performance period compared to same period in previous year by municipal water bills if the total potential points are not fully targeted in water efficiency.

A further 1 point is rewarded where this improvement exceeds 10%.

DOCUMENTATION REQUIREMENTS/EVIDENCE

Submit all evidence and ensure it readily confirms compliance; also complete online submission template/check list. Applicants must provide all documentation that supports their claims and calculations.

Criteria	Documentation
All	Completed Submission Template
Minimum Requirement	12 consecutive months of water consumption data to establish an Water consumption baseline

EB-WAT-1 Potable Water

POINTS AVAILABLE **12**

Compliance Path 1	• **Completed GBCSA 'EWP' Tool** Benchmarking Calculator (Offices) o Detailed input page to be completed and vacancies to be accounted for. • **12 consecutive months of water consumption data** (utility bills or meter readings signed off by contractor or facilities person responsible for meter readings)
Compliance Path 2	• **Completed EBP Water Calculator** • **12 consecutive months of water consumption data** for all buildings (utility bills or meter readings signed off by contractor or facilities person responsible for meter readings) • **Short Report on Normalising Methodology** (where applicable) signed off by suitably qualified professional.
Compliance Path 3	• **Completed EBP Water Calculator** • **12 consecutive months of water consumption data** for the baseline period and the Performance Period (utility bills or meter readings signed off by contractor or facilities person responsible for meter readings) • **Short Report on Normalising Methodology** (where applicable) signed off by suitably qualified professional.
Compliance Path 4	• **Completed EBP Water Calculator** • **12 consecutive months of water consumption data** (utility bills or meter readings signed off by contractor or facilities person responsible for meter readings) • **Attach an extract from the publication / document detailing the benchmark used.** • **Short Report on Normalising Methodology** (where applicable) signed off by suitably qualified professional.
Additional Points	• **Historical water consumption data** (utility bills or meter readings signed off by contractor)

Further Evidence* that may be Requested by Assessors:

Water Variance Factors such as:

- Proof of building area (GLA)
- Proof of number of occupants
- Proof of occupancy hours
- Proof of building address
- Proof of the type of operation conducted in the building

ADDITIONAL GUIDANCE / RESOURCES

Water consumption reduction

To ensure optimum water use efficiency the following aspects can be considered.

a. Analyze water consumption
   - Water account structuring
   - Staff encouragement and possible incentive programme to ensure responsible water use behavior
   - Water leak detection
   - Water meter / sub meter installations
   - Load investigation / record keeping
   - Low pressure regulators

b. Reduce water consumption by installing:
   - Low flow shower heads and taps
   - Low flush or waterless toilets
   - Moisture sensor irrigation
   - Water saving appliances
   - Dual water systems

c. Re-use by installing:
   - Irrigation integration
   - Grey water collection
   - Rain water collection
   - Mechanical water use
   - Fire system water use

d. Recycle by installing
   - Black water recycling
   - Grey water recycling
   - Irrigation water recycling
   - Condensation recovery
   - Non-potable water use

e. Monitor by implementing:
   - Education programmes
   - Water reduction strategies
   - Development of strategies
   - On site specific water balance
   - Assess local authorities

Example of Simplified Normalising Method

Scaling factors are often employed to normalize variables to allow direct comparison between the baseline data and data of the building being rated. The typical formula for calculating scaling factors is shown below.

$$\textbf{Scaling factor}_{\textbf{Variable}} = \frac{\textbf{Value for Operating Variable for building to be rated}}{\textbf{Value for Operating Variable for Benchmark Buildings}}$$

Example – Operating hours

Benchmark Buildings = 80 hours

Building being rated = 85 hours

The calculation of scaling factor for Operating Hours will be:

$$\textbf{Scaling factor}_{\textbf{Operating Hours}} = \frac{85}{80} = 1.0625$$

This scaling factor can then be multiplied (or divided, depending on the application) to the comparison values to adjust it for comparison purposes. In some cases, the scaling factor will be applied to a portion (percentage) of the result due to the fact that the factor does not influence the total water consumptions but only a portion. When this is applied, the logical methodology of why the scaling factor is applied to a certain percentage of the result is required.

It is understood that not all factors have a linear relationship with performance, but this simplified method is acceptable for the purpose of this tool.

BACKGROUND

Water is essential for life. In a lot of cases this water is used unconsciously and unnecessarily. In a water scarce country this is going to weight heavy on the future. The saving and conservation of water is therefore essential.

Rainwater, Grey water & Blackwater

Collecting rainwater from roofs and other impervious surfaces can add to the amount of sustainable water available for use in buildings. Retail centres with large roof areas are particularly well suited for rainwater collection.

Grey water can be recovered from sinks and showers, washing machines, cooling towers and other water sources that do not contain food or human waste. This water can be stored for irrigation and toilet flushing but needs to be used within a short period following collection to avoid having extensive treatment requirements. In locations where on-site black water treatment is generally not permitted, projects should consider contacting local authorities to discuss the benefits of on-site water treatment for the project and local infrastructure.

Water Efficiency Labelling Scheme

The South African Government, through the Department of Water Affairs (DWA), is currently working with the South African National Standards to introduce the Water Efficiency Labelling and Standards (WELS) Scheme that involves the introduction of national mandatory water efficiency labelling and minimum performance standards for domestic water-using devices.

Landscaping Water Efficiency

Potable water demand can be reduced through the installation of water-efficient irrigation systems (such as sub-soil or drip irrigation) or through the use of sustainable water for landscape irrigation. A ‘xeriscape garden’ is defined as a water-conserving garden, or garden requiring no additional watering. Where a ‘xeriscape garden’ has been installed, provisions must be made to remove any irrigation system within twelve months and ensure that the landscape will not receive watering after that time. Evidence will include, but will not be limited to, a report from the landscape architect confirming why the design can be classified as ‘xeriscape’.

Heat Rejection

The use of water based heat rejection systems that consume huge amounts of water through cooling towers is wide spread because of the high Water efficiency of such systems.

EB-WAT-1 Potable Water

POINTS AVAILABLE **12**

Minimising or eliminating the use of potable water in heat rejection systems or completely eliminating the need for mechanical cooling in buildings can achieve significant savings in both Water and water. The use of non-chemical dosing (such as ionisation, UV treatment, etc.) can save water by avoiding more frequent flushing of cooling tower water systems.

Laundry Equipment

The typical laundry utilises a washer technology called washer-extractors. This type of machine ranges in size from about 16 kg up to 1 766 kg in the largest laundries. The name washer-extractor is used because after each portion of the wash cycle (soak, suds, pre-wash, wash, rinse, or finish) an extraction imparting centrifugal force removes the water and detergent contents from the wash wheel to the drain.

Other equipment found in large industrial laundries are tunnel washers (or continuous batch washers), which is an industrial laundry machine designed for heavy loads. Tunnel washers are inherently water-efficient; water is used several times before being sent to the drain. Average water consumption of this type of equipment is 16 litres per kilogram of laundry, which is 2/3 of the typical washer extractor.

Water recycling in laundry processes can be done quite easily. The last rinse water used in an industrial washer can be reused as a pre-wash for the next wash cycle. Larger commercial and industrial laundries have been utilising this technology for decades. For smaller laundries it is not common practice due to the high upfront cost. However in recent year, washing machine manufacturers have been designing systems that are less expensive and require less space.

Most commercial washer-extractors can be retrofitted with a tank to save the final rinse water, which can then be reused as pre-wash in the next load. It is possible to cut the potable water consumption by 30% by reusing water from the final rinse cycle for the next load.

Large Kitchens

Inefficient use of water in kitchen operations is usually a result of equipment design and/or behavioural patterns. The main types of water using equipment found in kitchens are dishwashers, sinks, woks, steamers, pre-wash spray rinse units, ice-making machines and garbage disposal units.

Dishwashers

Substantial savings can be made with a new dishwasher; newer models use less water, also different type of dishwashers has different flow rates. Below are the most common ones with their average water consumption.

Type	Description	Litres per rack
Under counter	A machine with an overall height of 1 meter or less, in which a rack of dishes remains stationary within the machine while being subjected to sequential wash and rinse sprays, and is designed to be installed under food preparation workspaces.	13 ltr/rack

Single Tank Door	A machine in which a rack of dishes remains stationary within the machine while subjected to sequential wash and rinse sprays. This definition also applies to machines in which the rack revolves on an axis during the wash and rinse cycles.	8.4 ltr/rack
Tank conveyor	A washing machine that employs a conveyor or Similar mechanism to carry dishes through a series of wash and rinse sprays within the machine. Specifically, a single tank conveyor machine has a tank for wash water followed by a final sanitizing rinse and does not have a pumped rinse tank.	6.0 ltr/rack
Multiple Tank conveyor	A conveyor type machine that has one or more tanks for wash water and one or more tanks for pumped rinse water, followed by a final sanitizing rinse.	4.1 litre/rack

Source:
http://www.Waterstar.gov/index.cfm?c=comm_dishwashers.pr_crit_comm_dishwashers
(See Table: WAT-1.1: Description of types of dishwashers.)

Commercial Car Wash Facility
Commercial Car Wash Facilities use large amounts of water. The amount of potable water to wash cars varies depending on the method used from bucket and hand wash to open hose spray and industrial high pressure conveyor carwash system.
One of the largest car rental companies of South Africa has invested in reducing and recycling the water used to wash the vehicles. They procured a conveyor bay type of wash system which washes a car within 45 seconds. It further included the construction of underground water filtration and recycling facilities that filters the waste water and reuses it in the wash cycle. Rainwater is also collected and used for car washing. Potable water is only used for the final rise, minimising potable water use to the bare minimum. All interventions saved the company approximately 100 million litres of water annually.

Laboratories
In meeting their large cooling and process water demands, most laboratories use significantly more water per square metre than standard commercial buildings (US EPA, 2005). As an example, the

Australian National University has estimated that 45% of the 750 million litres of water used annually are consumed in its laboratories, compared to 25% used in accommodation and 15% in irrigation (ANU, 2008). This demand arises from space cooling requirements, water used in the activity of the laboratory and equipment cooling (the focus of this credit).

Single-pass or once-through systems are commonly used to cool a broad range of scientific and medical equipment from CAT scanners to mass spectrometers. These systems circulate water, typically directly from the public water supply, once through the piece of equipment and then discharges directly to the sewer. These systems are the most water intensive cooling methods used in laboratories; consuming approximately 40 times the water required by cooling towers to remove the same heat load (US

Source: GREEN STAR SA – PUBLIC & EDUCATION BUILDING v1 2013 TECHNICAL MANUAL

REFERENCES

GBSA benchmarking tool
The GBCSA's Water & Water Benchmarking Tool for office buildings (currently in PILOT) for the building type. See **http://www.gbcsa.org.za/other-tools/Water-water-benchmark/**

Water Efficiency Guide: office and public buildings, Australian Government, Department of The Environment and Heritage, 2006, ISBN 06425 52878

Best Practice – How to achieve the most efficient use of water in commercial food service facilities. **www.Waterstar.com**

South African Weather Service. www.weathersa.co.za

South Africa Department of Water Affairs. www.dwa.gov.za

Water Efficiency South Africa. www.waterefficiency.co.za

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

EB-MAT-1 Procurement and Purchasing

POINTS AVAILABLE 4

AIM OF CREDIT

To recognize procurement and purchasing practices which encourage use of products that are environmentally preferable.

CREDIT CRITERIA

Green Procurement Policy	**4 points** will be awarded where there is evidence of a green procurement policy that has been put in place during the performance period.

COMPLIANCE REQUIREMENTS / EVIDENCE

Green Procurement Policy

A green procurement policy must be in place during the performance period. The Policy must align with the Green Star SA – Policy & Programme Model (adapted as shown below, for this credit).

Purpose	Describe policy aim in terms of the building's management strategy and broadly outline parties involved or affected.
Scope	Describe management personnel responsible for executing the policy. Furthermore, policy document should mention all products targeted for selection as environmentally preferable products. Examples of products that can be included: *Operational Consumables.* • Paper — Recycled Content • Plastic — Re-useable Content • Printer/ Copier Cartridges — Recycled/ re-filled *Construction Materials: Building Refurbishment, Alteration and Extension* • Lighting — Energy efficient luminaires with electronic ballasts • Floor Coverings / Carpets — Recycled content • Paints, sealants & solvents — Low VOC • Sealants — Low VOC • Solvents — Low VOC *Furniture and Moveable Equipment* • Electronic Copiers — Energy Star • Electronic Printers — Energy Star

	• Electronic Monitors	Energy Star
	• Electric Refrigerators	Energy Star
	• Electric Microwave	Energy Star
	• Electric Dishwashers	Energy Star
	• Furniture: Desks	FSC Certified Timber / Low Formaldehyde Content
	• Furniture: Cupboards	FSC Certified Timber / Low Formaldehyde Content
	• Furniture: Shelves & Bookcases	FSC Certified Timber / Low Formaldehyde Content

Goals and Policy Rules	Define specific goals for each product category or procurement practice and outline what action will be undertaken to ensure compliance with the set targets.
Performance Metrics	Include targets for sustainable procurement of environmentally preferable products. E.g. document can show targets as a percentage of total products procured for the building.
Procedures and Strategies	Under this section of the policy, the following information should be clearly mentioned: **(a) Life Cycle Assessment (LCA)** Details of a life cycle assessment process required to evaluate procurement decisions made in respect of furniture, building finishes, movable and fixed equipment. The life cycle assessment process should demonstrate how products will be assessed based on: • Environmental footprint (carbon footprint, energy) and methodology for reducing impact to the environment. • Supplier's environmental performance plan. • Total life cycle costs examination throughout life cycle where two or more products are compared. This can be a cash flow assessment over a 15 to 20 year period where the total cost (including replacements, refurbishment and maintenance activities) are indicated over the period. Decisions are based on Net Present Value (NPV) calculation and total cost over the period. The policy document must show intended outcomes such as: • The lowest building energy consumption over the operational life span of the building • A reduction in maintenance requirement/frequency • Prolonged replacement intervals of services infrastructure/systems or building fabric

- Dismantling and recycling or re-use of building components

(b) Selection of environmentally preferable products

The policy should mention the methods used to declare selected products as environmentally preferable. Below are some of the examples of available methods:

Example 1: Selecting products based on their **Eco-label** accreditation status.

Example 2: Products that demonstrate adherence to any credible method, system or tool that considers the product's environmental impact of the following factors:

- Product material sourcing
- Product manufacture
- Product disposal
- Recycled content
- Recyclability
- Impact to human health

Example 3: The policy can propose that the following checklist* be used as a framework for product selection.

Manufacturing Phase	
1. Have virgin materials been used in the product?	Y/N
2. Have recycled materials been used in the product? If the proportion of content made up by recycled materials is known, capture this information	Y/N *(% content of product)*
3. Has the manufacturer taken steps to avoid and minimise the generation of waste in the production of the goods?	List actions taken
4. Has the manufacturer taken steps to minimise the use of energy in the production of goods?	List actions taken
5. Has the manufacturer taken steps to minimise they emissions of air pollutants in the production of the goods?	List actions taken
6. Has the manufacturer used any hazardous substances in the product?	Y/N *If Y, list hazardous substances*
7. Does the supplier have any form of environmental certification (e.g. ISO 14001)?	Y/N If Y, list
Use Phase	
8. Can the product be reused (e.g. able to accept refills of ink)?	Y/N

<table>
<tr><td></td><td>
<table>
<tr><td></td><td>Detail how it can be reused</td></tr>
<tr><td>9. Does the product have an Energy Star Rating?
10. Is the Product Energy Efficient</td><td>Y/N
Supplier to compare energy efficiency with other similar products</td></tr>
<tr><td>11. Does the product come with supplier guarantee of quality?
12. Does the product come with a maintenance plan?</td><td>Y/N
Y/N</td></tr>
<tr><td colspan="2">Disposal Phase</td></tr>
<tr><td>13. Can the product be recycled?</td><td>Y/N</td></tr>
<tr><td>14. Has the supplier provided information on how he plans to dispose of the product?
15. Has he considered environmentally friendly options?</td><td>Y/N
List disposal options</td></tr>
<tr><td>16. Where hazardous substances are used, has the supplier detailed how he plans to dispose of the product?</td><td>Y/N
List disposal</td></tr>
</table>
*Adapted from the Province of Western Cape: Provincial Gazette 6733 – Green Paper on Greening the Procurement of Goods and Services in the Provincial Government of the Western Cape.
</td></tr>
<tr><td>Quality Assurance Control Process</td><td>Include systems and processes to be implemented to assure compliance to committed quality and performance.</td></tr>
<tr><td>Responsibilities and Accountability</td><td>Mention responsible parties within the building or organisation for execution of the policy. Parties must represent different levels within building management or organisation.</td></tr>
<tr><td>Time Period</td><td>Period in which the policy will remain in force.</td></tr>
</table>

N.B. Although it is not necessary for organizations seeking certification to develop new policies for Green Star SA ratings, projects are required to highlight - and where not present in existing policies, amend these to include - all elements of the Green Star SA Policy and Programme Model.

EB-MAT-1 Procurement and Purchasing

POINTS AVAILABLE 4

DOCUMENTATION REQUIREMENTS

Submit all the evidence and ensure it readily shows compliance with the following:

Criteria	Documentation
Green Procurement Policy	• **Completed Submission Checklist** • **Copy of Green Procurement Policy**

ADDITIONAL GUIDANCE / RESOURCES

Green Procurement Objectives

The building blocks of green procurement and purchasing practices are based on the following fundamental objectives:

1. Avoiding unnecessary consumption and managing demand.
2. Minimising environmental impact.
3. Seeking value for money.
4. Enforcing supplier's social and ethical responsibility.

BACKGROUND

What is Green Procurement?

Green procurement is the process whereby economic development, social development and environmental protection are balanced against business needs, taking into account the:

- entire life cycle cost of the product
- quality required by the specification
- availability of the product.
- functionality of the product in the environment to which it is to be applied
- effect the product will have on the environment when in service
- labour conditions of the producer and the human rights of the workforce
- use of sustainable or recycled materials and/or products.
- reduction of waste

The Benefits of Green Procurement

- Control of costs by adopting a wider approach to whole life costing.
- Improvement of internal and external standards through Performance Assessments.
- Compliance with environmental and social legislation.
- Effective management of risk and reputation.

- Build a sustainable supply chain for the future.

REFERENCES

International Institute for Sustainable Development

http://www.iisd.org/

Constitution of the Republic of South Africa, Act 108 of 1996, Section 24

National Environmental Management Act, 107 of 1998 (NEMA), Section 2

Hazardous Substances Act, 15 of 1973

Province of Western Cape: Provincial Gazette 6733 – Green Paper on Greening the Procurement of Goods and Services in the Provincial Government of the Western Cape

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

EB-MAT-2 Solid Waste Management

POINTS AVAILABLE 7

AIM OF CREDIT

To reward operational practices which reduce the amount of solid waste going to landfill. Such waste may be from typical building operations, including on-going and durable goods, and from refurbishments, construction or demolition works.

CREDIT CRITERIA

Solid Waste and Materials Management Policy	**1 point** is awarded where a compliant Solid Waste and Materials Management Policy is in place during the performance period* that covers a building's entire waste stream, including, at a minimum the following: • Ongoing Consumables, • Hazardous Materials, • Movable and Electronic Goods and • Construction Waste from Churn and Alterations
Waste Stream Audit of Ongoing Consumables and development of an Operational Waste and Materials Management Plan	**1 point** is awarded where a building carries out a waste stream audit of the building's entire ongoing consumable waste stream to establish a baseline that identifies the types and amounts of waste making up the waste stream, thereby identifying opportunities for increased waste minimisation, recycling and waste diversion. An operational waste and materials management plan (OWMMP) must be developed on the basis of this audit and to outline clearly opportunities for waste minimisation.
Waste to Landfill Diversion: Operational waste and materials	**Up to 3 points** are awarded where the following percentages (by mass or volume) of operational waste and materials are diverted from landfill during the performance period*: 25% = 1 point 50% = 1.5 points 75% = 2 points And where no hazardous waste (e.g. CFL lamps) and batteries enter the operational waste and materials stream and are collected through a separate process. **1 point** is awarded where overall operational waste and materials generated (tonnage or volume) has been reduced by at least 10% over the performance period when compared to the baseline month at the beginning of the performance period.
Waste to Landfill Diversion: Movable and/or Electronic Goods	**0.5 points** are awarded where 75% of all movable goods waste is diverted from landfill during the performance period and where no electronic goods enter the movable goods waste stream and are collected and responsibly managed through a separate collection process.

Waste to Landfill Diversion: Construction Waste – Churn and Alterations	**0.5 points** are awarded where 50% of total construction waste from churn and alterations generated during the performance period is diverted from landfill. This portion of the credit is N/A if no churn or alterations took place during the performance period.

All Requirements above relate to waste which is processing under the control of the Building Management Team. Where tenants or contractors are responsible for certain waste streams and this waste thus does not enter the building management's facility, it can be excluded from compliance.

SOLID WASTE AND MATERIALS MANAGEMENT POLICY

N.B. Although it is not necessary for organizations seeking certification to develop separate policies, projects are required to highlight - and where not present in existing policies, amend these to include - all elements of the Green Star SA Policy Model (available from the GBCSA on request) as well as the requirements outlined below.

A Solid Waste and Materials Management Policy, which is a minimum requirement, must be developed and adopted prior to the start of the performance period and must be in place for the building(s) and site throughout the performance period. The Policy must be in line with the Green Star Policy and Programme/Plan Model and cover, at a minimum, the following requirements:

- Standards and Performance Measurements and Metrics:
  - Clearly stipulate the waste minimisation goals for particular waste categories
  - Clearly stipulate the targeted diversion rates from landfill relating to waste streams such as the following:
    - Ongoing operational waste and materials.
    - Food waste
    - Landscape waste
    - Batteries
    - Hazardous Waste (e.g. CFL lamps)
    - Electronic Waste
    - Movable goods
    - Waste from Construction Activities as a result of Churn and Alterations

- Implementation Procedures and Strategies
  - Clearly set out the Standard Operating Procedures which outline the implementation of the waste diversion practices at the project building(s), including onsite waste and materials practices and staff and contractor education
  - Include in the procedures and strategies means to ensure resource use reduction through, for instance, targeted reduction in unnecessary packaging in the building consumables supply chain

- Quality Assurance Control Processes
  - Stipulate the quality assurance control system that must be in place to ensure the implementation of the solid waste and materials policy
  - Include solid waste and materials performance specific wording in tender documentation and/or service level agreements that clearly identifies responsibilities and targets
  - Put processes in place that ensure that the appointed waste contractor(s) comply with all relevant legislation, including being registered on the SAWIS (South African Waste Information System)

The Solid Waste and Materials Management Policy can be an existing, company-wide policy that covers, at a minimum, the above requirements and is implemented on an individual building level. Although the policy does not have to be developed specifically for the purpose of Green Star SA Performance certification, adherence to the Green Star Policy model is required. Where there are statutory requirements regarding waste diversion of process waste, such as medical waste or industrial/manufacturing waste and others, these requirements must, at a minimum, be referenced in the policy but such waste is not subject to the certification assessment process as part of a Green Star SA certification.

WASTE AND MATERIALS STREAM AUDIT

At the beginning of the performance period and prior to developing an Operational Waste and Materials Management Plan, conduct a waste and materials stream audit at the project building(s) of the entire operational waste and materials stream.

The waste stream audit should be carried out over a period representative of typical operations of the building. E.g. typical week during the building's operations.

The entire waste stream at the project building which would normally leave the site and be directed to landfill, incineration, recycling, composting, or resale or be reused in the building that would otherwise have been considered waste, must be audited. This typically includes the following, but the waste streams will depend on the particular project building and operations:

  - ongoing consumables from normal building operations
  - toners and cartridges
  - ongoing e-waste (e.g. batteries, hazardous waste, such as CFL lamps
  - bathroom waste
  - food waste
  - landscape and garden waste from the project site
- exclude waste streams that require specialist waste diversion measures and are regulated, such as medicinal waste, hazardous waste and others that would not normally enter the operational waste and materials stream
- exclude from the audit movable and/or electronic goods and construction waste resulting from churn and alterations

The audit involves the separation of the waste stream into its individual components and should be in accordance with the NEM:WA waste characterisation criteria and waste classification system. Where possible this can be done by the waste management contractor provided the data is directly linked to the project building and not an estimation of the waste stream components due to co-mingling with waste streams from other buildings, unless these buildings are located on a campus/precinct managed by one entity where a central waste storage and processing system is in place. Where specific data for items such as shredded paper, hazardous waste or other operational waste and materials is available from specialist contractors this can be included in the overall calculations.

Where no accurate waste stream can be obtained from waste management contractors, the waste stream audit must be carried out onsite and can be conducted by facility/in-house staff.

Calculations
Determine the appropriate unit for the waste stream audit, either volume or weight. This unit must be used consistently throughout the audit.

OPERATIONAL WASTE AND MATERIALS MANAGEMENT PLAN

On the basis of the waste stream audit, develop an Operational Waste and Materials Management Plan (OWMMP), which will be an extension of the Solid Waste and Materials Management Policy and must specifically address the treatment of waste and materials disposal and recycling. Such an

OWMMP must be in place and operational during the performance period. Identify the objectives of the plan, by setting diversion from landfill targets (recycling targets) and/or target for reducing total materials generation (waste materials + recyclable materials);

	Operational Waste and Materials Management Plan -	
1	**Scope**: Identify the areas to which the OWMMP applies. For instance in a shopping centre, some shops may be responsible for their own waste management. Where this is the case, this must be clearly identified within the OWMMP.	☑
2	**Goals**: Identify waste and materials streams. These streams must include at least general waste, paper and cardboard, glass and plastic; in addition, identify waste streams that can be reduced upfront, such as through reusable packaging, refillable toners and others. Such identification must be in line with the waste classification relevant at the time of developing the OWMMP.	☑
3	Identify at least one additional waste and materials stream over and above the waste and materials stream identified in 2 above, that can be recycled and for which recycling facilities are provided during the performance period and where such a waste stream must be of significant volumes as identified during the waste stream audit. Examples of other waste streams that can be recycled include: metal, food waste and kitchen scraps, cooking oil, batteries and electronics.	☑
4	**Procedures and Strategies**: Clearly identify opportunities for waste and materials stream reduction (minimisation) and waste stream diversion and develop strategies accordingly	☑
5	**Responsibilities**: Outline individual roles responsible for reviewing and delivering the OWMMP	☑
6	**Performance Metrics**: Outline monitoring and measurement procedures for waste, materials and recycling streams by weight or volume	☑
7	**Quality Assurance**: Incorporate a review process to assess the success of the OWMMP and make improvements based on lessons learned	☑
8	**Time Period:** Clearly stipulate the time-period during which the OWMMP has to be in place and how often review processes have to be carried out.	☑

Similarly to the Solid Waste and Materials Management Policy, project buildings may already have in place a waste management/operational waste and materials management plan. Regardless, the OWMMP must be in line with the Green Star SA Policy and Plan/Programme Model (available on request from the GBCSA) and the requirements outlined and specifically address the operations of the building seeking certification. The OWMMP may be a standalone plan or be part of a more comprehensive Environmental Management System, as long as it is also implemented at a building level and meets the requirements outlined in this credit.

WASTE TO LANDFILL DIVERSION: OPERATIONAL WASTE AND MATERIALS

Calculations – Waste and Materials Stream Diversion

Waste Diversion includes source reduction, reuse, and recycling. The amount for each method of diversion must be quantified accurately and supported with documentation. The waste contractor can provide the required tracking information and supporting documentation that confirms compliance with the credit criteria.

Where the waste contractor cannot provide this information, calculate the portion of ongoing consumables in the waste stream that have been reused, recycled, or composted, where the following process should be used:

1. Use the waste contractors' reports or similarly reliable data to determine the total weight or volume of waste that was diverted from landfill/conventional disposal through reuse, recycling or composting. Data for this purpose must represent the entire performance period and may not be extrapolated.

2. Calculate the portion of ongoing consumables (as a percentage) which were diverted from the waste stream by means of recycling, reuse or composting.

Confirmation that all batteries and hazardous operational waste and materials, such as CFL lamps, have been diverted from landfill is required

WASTE MINIMISATION

Waste Minimisation focuses on upfront reduction of items that could potentially enter the waste stream, whether ultimately designated for recycling or landfill. Avoided waste remains the best course of action to minimise waste and meet diversion targets. Waste minimisation necessarily goes hand in hand with sustainable procurement and purchasing strategies**,** where numerous strategies can be employed.

Examples include

Waste Minimisation Criteria	**Strategies**
Durability vs Obsolescence	favouring products that are designed for longer life and extending that life span through repair and reconditioning.
Disposables vs. long life products	avoiding products, which are designed for single or short life usage, including items such as non-refillable ball-point pens marker pens, plastic cups and cutlery and replacing these with longer life products.
Procurement Preferences	Contractor take-back scheme for packaging Products with high recycled content and refillable/reusable Products with little or no packaging Concentrated product vs diluted products where feasible Bulk purchasing
Operational Choices	e.g. Double-sided printing, minimising printing and reusing scrap paper

Develop waste minimisation strategies on the basis of the Waste and Materials Stream audit and track these during the performance period, where the Waste Stream Audit forms the baseline for documenting an overall waste reduction over a 12 months period.

Calculations - Waste Minimisation

Where projects already have a waste and materials tracking system in place, compare waste minimisation on a month to month basis, i.e. $month_{1\ year\ 1}$ vs $month_{1\ year\ 2}$.

Where such data is not available, track operational waste and materials over a 13 months period, where the first month ($month_0$) establishes the baseline. Track all operational waste and materials generated on a monthly basis and establish the overall waste reduction as follows:

$$(month_0 – ((month_{1...12})/12))/month_0 \times 100 = \text{overall waste reduction}$$

0.5 points are awarded where a project can document a minimum overall waste reduction of 10%.

WASTE TO LANDFILL DIVERSION: MOVABLE AND/OR ELECTRONIC GOODS

Where a formal diversion programme is already in place, which stipulates and regulates the diversion of movable goods from landfill, proof of this can be submitted in lieu of calculations. Such a programme can be managed in-house or through an external contractor.

Where no formal diversion programme of movable goods exists, please use the following calculations.

Calculations

Waste Diversion is measured by the total amount (volume, weight or replacement value) of items sent for recycling or sold or donated as a portion of total waste generated. The amount for each method of diversion must be quantified accurately and supported with documentation. To calculate the portion of movable and/or electronic goods in the waste stream that have been recycled, donated or sold, use the following process:

1. For all movable and/or electronic goods handled by waste contractors, use the waste contractors' reports or similarly reliable data to determine the total movable and/or electronic goods waste volume, weight or replacement value for the performance period. Data for this purpose must represent the entire performance period and may not be extrapolated.

2. Use the waste contractors' reports or similarly reliable data to determine the total movable goods waste volume, weight or replacement value that was diverted from landfill/conventional disposal through recycling, sale or donation. Data for this purpose must represent the entire performance period and may not be extrapolated.

3. Calculate the portion of movable and/or electronic goods recycled or sold/donated.

For the purpose of this credit, the replacement value of an item is the cost of the item from a shop, reflecting its age and condition.

Waste to Landfill Diversion: Construction Waste – Churn and Alterations

Where projects undergo churn, alterations or additions during the performance period, such waste must be diverted from landfill as per the table below. This credit is only applicable to projects where construction activities as a result of Churn, Alteration or Additions are taking place during the performance period.

Where a formal diversion programme is already in place, which stipulates and regulates the diversion of construction waste from landfill, proof of this can be submitted in lieu of calculations. Such a programme can be managed in-house or through an external contractor.

Where no formal diversion programme of construction waste exists, please use the following calculations.

Calculations

Waste Diversion is measured by the total amount (volume, weight or replacement value) of items sent for recycling or sold or donated as a portion of total waste generated. The amount for each method of diversion must be quantified accurately and supported with documentation. To calculate the portion of construction waste in the waste stream that have been recycled, donated or sold, use the following process:

EB-MAT-2 Solid Waste Management

POINTS AVAILABLE 7

1. For all construction waste handled by waste contractors, use the waste contractors' reports or similarly reliable data to determine the total construction waste volume or weight for the performance period. Data for this purpose must represent the entire performance period and may not be extrapolated.
2. Use the waste contractors' reports or similarly reliable data to determine the total construction waste volume, weight or replacement value that was diverted from landfill/conventional disposal through recycling, sale or donation. Data for this purpose must represent the entire performance period and may not be extrapolated.
3. Calculate the portion of construction waste recycled or sold/donated.

Base building elements	Minimum diversion from landfill rate by weight or volume
Numerous building materials and components can be recovered or recycled. Common materials and reuses include: • Bricks and concrete used for clean-fill; • Timber to be salvaged for new structural or material use; timber waste ground into mulch or garden compost; • Crushed concrete used as road-base; • Plasterboard crushed for soil conditioner or for the manufacture of new plasterboard; • Steel, aluminium and other metals for reuse in the manufacture of new metal products; • Foam insulation and packaging for new insulation or soft structural forms; • Pallets for reuse • Clean plastic from packaging for new packaging materials; • Carpet and ceiling tiles may be taken back for reconditioning/recycling by the manufacturer; • Light fixtures for cleaning and reuse; • Furniture for refurbishing and reuse; and • Crushed tiles for paving or landscape decoration.	50%

DOCUMENTATION REQUIREMENTS

Criteria	Documentation
All	• **Completed Submission Template**
Solid Waste Management Policy	• **Copy of the Solid Waste and Materials Management Policy**
Waste Stream Audit & Operational Waste and Materials Management Plan	• **Copy of the Waste Stream Audit Report** and results • **Copy of the Operational Waste and Materials Management Plan,** confirming the content of the elements that need to be covered in this audit.
Waste to Landfill Diversion: Operational	• **Calculations of Diversion Rate** OR • **Supply Waste Contractor Report** confirming compliance and confirming that no hazardous waste (e.g. CFL lamps) and batteries

Waste and Materials	enter the operational waste stream and are collected through a separate process. • **Supply Waste Contractor Receipts** confirming the diversion rate
Waste to Landfill Diversion: Movable and/or Electronic Goods	• **Calculations of Diversion Rate** OR • **Supply Waste Contractor Report** confirming compliance • **Supply Waste Contractor Receipts** confirming the diversion rate OR • **Evidence of Formal Diversion Programme** for movable & electronic goods.
Waste to Landfill Diversion: Construction Waste – Churn and Alterations	• **Calculations of Diversion Rate** OR • **Supply Waste Contractor Report** confirming compliance • **Supply Waste Contractor Receipts** confirming the diversion rate OR • **Evidence of Formal Diversion Programme** for construction waste.

ADDITIONAL GUIDANCE / RESOURCES

The availability waste management services and options varies from Province to Province and must be researched and implemented on a case-by-case basis. Engage with your current waste management contractor to establish clear roles and responsibilities and review their ability to meet the building's solid waste and materials management goals.

Solid Waste and Materials Management Policy

Drafting and agreeing a policy is a collaborative effort, which requires input from the building owner, facilities management, procurement officers and product suppliers. Often the Facilities Manager heads up the development of a Solid Waste and Materials Management Policy and is often responsible for the implementation. Developing and implementing a solid waste and materials management policy can set the overall tone for waste minimisation and diversion and is the first step in ensuring successful and sustained implementation.

Waste Stream Audit

Becoming aware of a building's actual waste stream generated on a regular basis can help identify opportunities for source reduction, reuse, recycling, composting and other means of diversion and help identify appropriate infrastructure that will aid in the upfront collection and separation of waste streams and can tailor service provider responses to the waste stream of a particular project. In addition, with building users being made aware of actual waste stream information, appropriate mechanisms can be put in place that a) reduce upfront waste generation (packaging etc.), b) target reuse strategies and c) improve recycling rates.

Waste to Landfill Diversion

Although putting in place an effective and successful recycling programme with associated ongoing tracking may require time, effort and additional capital expenses (recycling infrastructure), the benefits usually associated with successful recycling programmes can far outweigh the costs. Such benefits tend to include reduced costs associated with materials purchases (e.g. packaging); reduced waste collection and disposal fees and/or income derived from recycling companies. A long-term commitment to tracking, monitoring and maintenance is essential.

EB-MAT-2 Solid Waste Management

POINTS AVAILABLE 7

BACKGROUND

Normal building operations and maintenance as well as churn and alterations can generate substantial quantities of waste. By reducing the overall waste stream to landfill through source reduction, reuse, recycling and other waste diversion strategies the demand for new materials and related harvesting and extraction of natural resources can be reduced. Furthermore, reducing the amounts of waste going to landfill will help reduce the impact of landfills on greenhouse gas emissions and the overall impact that landfills have on land resource, air and water quality.

South African households, commerce, institutions and manufactures generate 13.5-15million tonnes of waste per year (1998). This is increasing due to population and economic growth. Gauteng, the most urbanised province, is responsible for 43% of the total waste generated in South Africa. Each person generates on average 760 kg of waste per year. (DEAT, 2006).

Disposal of waste generally has negative impacts on the environment. These impacts include contamination of surface and ground water resources and soil; emissions (methane, CO2 and others) due to natural decomposition processes, incineration and illegal burning; health and safety risks; unsightly landfill sites, etc. Processing waste provides a large scope for creating employment opportunities. Sorting of waste allows products that have a high reuse or recycle value to be extracted from conventional waste streams turning the burden of waste into a potential resource which reduces use of virgin material (DEAT, 2006).

Waste produced through the operation of a building arises from the daily processes of the building, management and maintenance activities and refurbishment associated churn (Terry & Moore, 2008). The majority of this waste is the consumables associated with the daily functions of the business, but significant environmental impacts can also arise from smaller waste streams. An example of this smaller waste stream is the replacement of the building's fluorescent lights, which commonly is on a time/cost rather than utility basis. Sent to landfill, a single fluorescent light, containing 10mg of mercury, can contaminate 30,000 litres of water beyond safe drinking standards (MTP, 2005).

According to the Paper Recycling Association of South Africa the recyclable paper recovery rate in 2006 for South Africa, as a percentage of paper consumption, was approximately 44%. When segmented, 'Offices' were performing at a recovery rate of 42%, whereas 'Homes' at only 14%. World total recovery levels showed slightly higher than the SA average at approximately 47%, with countries like Switzerland, The Netherlands and Germany at the top of the list with levels between 70% and 80%.

In addition to the environmental benefits from an effectively managed waste and recycling plan, there can be considerable economic savings. Sustainability Victoria's (2006) WasteWise programme reports that only 10% of the cost of waste is in its disposal. The other 90% is hidden costs including the costs associated with unproductive waste management work, storage and clean-up costs and the loss of valuable materials as waste. Effectively managing waste can result in reduced business risks and an enhanced social and corporate responsibility profile, which leads to in improved public relations and business continuity (Wasiluk, 2007).

To make recycling schemes more economic, it is beneficial for waste to be collected quickly and efficiently. A convenient, purpose-designed storage space ensures that sufficient waste is accumulated before it is collected, and helps occupants to store material. The purpose of this credit is to encourage and recognise the inclusion of storage space in the physical attributes of the building, regardless of the tenant operational policies such as contracting another company to segregate waste off-site.

Construction Waste during Churn and Alterations: Traditionally, the bulk of construction waste has gone to landfill, and it has been estimated by the Gauteng Provincial State of the Environment Report (SoER), June 2004, that construction and demolition waste within South Africa makes up

approximately one fourth of all waste generated. This occurs despite the fact that much of the waste can be considered as a valuable resource for reuse or recycling.

Waste management on building sites is becoming increasingly common. As the availability of suitable land for landfill diminishes, and concerns about the environmental implications of waste become more widespread, reuse and recycling practices increase.

At the National Waste Summit held in Polokwane in September 2001, the Polokwane Declaration was adopted which commits South Africa to a reduction of 50% in the amount of waste being land filled by 2012 and a plan for zero waste by 2022. Future waste legislation will promote reuse and recycling, and require manufacturers to develop products that do not create waste and that can easily be recycled.

South African Waste Information System: The Waste Act was implemented on 1 July 2009, and section 60(1) of the Waste Act requires the Minister to establish a national waste information system for the recording, collection, management and analysis of data and information on waste management. As such, the South African Waste Information System (SAWIS) was developed to support the reporting framework for the generators, recyclers, exporters and disposers of waste. Through its implementation, the SAWIS has proved to be a useful tool in informing waste management decisions. The SAWIS is a web-based system, which enables waste managers to register new waste activities and submit quarterly information on the following web-link www.sawic.org.za.

REFERENCES & FURTHER INFORMATION

Department of Environment and Tourism, http://www.environment.gov.za, http://www.environment.gov.za/ProjProg/WasteMgmt/recycling/an-a.htm

Department of Environmental Affairs and Tourism (2006) South Africa Environmental Outlook, A report on the state of the environment, http://soer.deat.gov.za/frontpage.aspx?m=2

EPA – Waste Wise: http://www.epa.gov/osw/conserve/smm/wastewise/measure-progress.htm

Inform Inc. (U.S.), Waste at Work: Prevention Strategies for the Bottom Line. http://www.informinc.org/wasteatwork.php

Institute of Waste Management of Southern Africa, http://www.iwmsa.co.za/

Market Transformation Programme (MPT) (2005) Light Emitting Diodes: Eco-Design, Innovation Roadmap, Future Energy Solutions, Didcot, UK

National Environmental Management: Waste Act (59/2008): National Waste Information Regulations

National Waste Management Strategy Implementation Project, (2005), http://www.sawic.org.za/documents/235.pdf

Paper Recycling Association of South Africa, http://www.prasa.co.za

Polokwane Declaration, http://www.environment.gov.za/ProjProg/WasteMgmt/Polokwane_declare.htm

Provincial State of the Environment Reports, http://soer.deat.gov.za/docport.aspx?m=97&d=5

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Terry, A & Moore, T [eds] (2008) Waste and Sustainable Commercial Buildings, Your Building: Profiting from sustainability, http://www.yourbuilding.org

USGBC, Leadership in Energy and Environmental Design (LEED) – Existing Buildings: Operations and Maintenance Reference Guide, 2009.

Wasiluk, K.L (2007), Business Case for Sustainable Commercial Buildings, http://www.yourbuilding.org

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

EB-ECO-1 Grounds-Keeping Practices

POINTS AVAILABLE 4

AIM OF CREDIT

To encourage environmentally sensitive maintenance and landscaping management practices for landscapes, hard surfaces and building exterior that reduce the environmental impact and improve ecological value and services.

CREDIT CRITERIA

Landscape Management	**2 points** are awarded where a plan is in place that details the site management of landscaped areas according to leading practice methods during the performance period.
	Where the site has 'natural vegetation' covering 25% or more of the total site area (excluding the building footprint**) or 5% of the total site area (including the building footprint)—whichever is greater, the following must be in place:** An Ecological Policy must be in place that states the overall intentions for ecological management of the site. 'Natural Vegetation' refers to undisturbed natural ecology of the area, i.e. not planted by or assisted by man.
Hard Surfaces and Building Exterior Management Plan	**1 point** is awarded where a plan is in place that details the management of hard surfaces and the building exterior according to leading practice methods during the performance period
Integrated Pest Management Plan	**1 point** is awarded where an Integrated Pest Management Plan for indoor and outdoor pest management is in place during the performance period.

Notes:

1. Although it is not necessary for organizations seeking certification to develop separate policies and plans to document compliance with credit criteria, projects are required to highlight - and where not present in existing policies/plans, amend these to include - all elements of the Green Star SA Policy and Programme/Plan Model as well as the requirements outlined in this credit for the applicable plan.
2. All plans that are submitted as part of this credit have to be developed in line with the Green Star SA Policy and Programme/Plan Model.

LANDSCAPE MANAGEMENT PLAN

Assessment

An assessment of current landscape practice, including but not limited to plant and planting schedules, fertilizer and irrigation regimes (as applicable), landscape waste management, and pest control practices is the first step in developing a landscape management plan. Work with the professional scientist/ landscape architect/ environmental management practitioner/ horticulturist (if applicable), and the contractor(s) responsible for landscape maintenance and planting, irrigation, waste, pest control and others as applicable to carry out the assessment.

EB-ECO-1 Grounds-Keeping Practices

POINTS AVAILABLE 4

Review the following elements on the site:

1. Plant Maintenance
    a. General Plant Maintenance:
    b. Plant Health
    c. Plant Replacement
2. Invasive Species Management
    a. Invasive species list
    b. Invasive Species Management
3. Landscape Waste Management
    a. Healthy plant material management
    b. Diseased plant disposal
4. Soil Management
    a. Fertilizers
    b. Erosion and Compaction
5. Irrigation and Water Use
    a. Irrigation timing and schedule
    b. Irrigation water source

Landscape Management Plan

On the basis of the assessment, develop a Landscape Management Plan, which must be in place during the performance period and covers at a minimum the assessed elements. The intent is that the plan contains clear procedures and strategies for landscape management, which will allow building owners and operators to maintain and improve landscaped areas, in accordance with leading practice.

The Landscape Management Plan must be written in line with the Green Star SA Policy and Programme/Plan model and must clearly outline the procedures and strategies that must be in place to maintain and improve landscaped areas during the performance period.

Below is a checklist (extracted from the Submission Template) outlining the required content of the Landscape Management Plan.

Table 1: Checklist - Landscape Management Plan

Landscape Management Plan		Included in Plan	Page number
Purpose			
Scope			
Goals and Plan Rules			
Performance Metrics			
Procedures and Strategies			
Plant stewardship			
	Plant Maintenance		
	Plant Health		
	Plant Replacement		
Invasive Species Management			
	Invasive Species List		
	Invasive Species Management		
Landscape Waste Management			
	Healthy plant material management		
	Diseased plant disposal		
Soil Management			
	Fertilizers		

EB-ECO-1 Grounds-Keeping Practices

POINTS AVAILABLE 4

	Erosion and compaction		
Irrigation and water use			
	Irrigation timing and schedule		
	Irrigation water source		
Quality Assurance Control Process			
	Recording and reporting mechanisms		
	Procedures for Non-compliance		
Responsibilities and Accountability			
Time Period			

Ecological Management

Where the site has natural vegetation covering at least of 25% of the total site area (excluding the building footprint) or 5% of the total site area (including the building footprint)—whichever is greater, the following must be in place to be eligible for the points under Landscape Management and Maintenance:

Ecological Policy

An Ecological Policy is a statement of commitment towards protecting and enhancing the ecological functioning of the site; and guides the organisation in this regard. The emphasis should be to improve the overall "function" (ecology) of the site and not only "form" (biodiversity). This policy statement must be in place during the performance period for any points to be awarded; and forms part of the Ecological Management Plan.

The policy must state as a minimum:

- A commitment to the maintenance of existing ecological value and improvement or positive contribution to the provision of ecosystem services;
- A stated target or end state to which the natural areas on site will be improved;
- Provisions to encourage all role-players to support the objectives of the policy;
- Indication of approval by relevant management structures.

It is the intention that this policy will guide and direct operational and maintenance requirement into the direction stated in the building owner's policy, at the premises level. It will also assist the organisation and their service providers with measuring and managing their biodiversity and ecological value, by making the desired outcomes clear to internal and external stakeholders.

See 'Additional Guidance' for examples of interventions that can be applied in line with the policy.

EB-ECO-1 Grounds-Keeping Practices

POINTS AVAILABLE 4

HARD SURFACES AND BUILDING EXTERIOR MAINTENANCE PLAN

Assessment

An assessment of current hard surfaces and building exterior maintenance practice and replacement schedules, is the first step in developing a Hard Surfaces and Building Exterior Maintenance Plan. Work with the building manager, maintenance contractor (if applicable), and the contractor(s) responsible for landscape maintenance and others as applicable to carry out the assessment.

Review the following elements on the site:

6. Hardscape Maintenance and Management
    a. General Hardscape Maintenance:
    b. Materials Functionality and Extended Use
    c. Cleaning methods and chemicals
    d. Maintenance of high reflective materials
    e. Site Safety
7. Landscape Maintenance Equipment
    a. Equipment Maintenance
    b. Low/zero-emissions and low-noise equipment
8. Energy and Water Consumption
    a. Energy Efficient Outdoor Fixtures and Equipment
    b. Potable Water Use Minimisation

Hard Surfaces and Building Exterior Maintenance Plan

On the basis of the assessment, develop a Hard Surfaces and Building Exterior Maintenance Plan to be in place during the performance period that covers at a minimum the assessed elements. The intent is that the plan contains clear procedures that are being used to maintain and/or improve hard surfaces and building envelopes during the performance period.

The Hard Surfaces and Building Exterior Maintenance Plan must be written in line with the Green Star SA Policy and Programme/Plan model and must clearly outline the procedures and strategies that must be in place to maintain and improve landscaped areas during the performance period.

Below is a checklist (extracted from the Submission Template) outlining the required content of the Hard Surfaces and Building Exterior Maintenance Plan.

Table 2: Checklist - Hard Surfaces & Building Exterior Maintenance Plan

Hard Surfaces and Building Exterior Management Plan		Included in Plan	Page number
Purpose			
Scope			
Goals and Plan Rules			
Performance Metrics			
Procedures and Strategies			
Hardscape Maintenance and Management			
	General Hardscape Maintenance		
	Material Functionality and Extended Use		
	Outdoor cleaning methods and chemicals		

	Maintenance of high reflective materials		
	Site Safety		
Landscape Maintenance Equipment			
	Equipment Maintenance		
	Low/zero-emissions and low- noise equipment		
Energy and Water Consumption			
	Energy Efficient Outdoor Fixtures and Equipment		
	Potable Water Use Minimisation		
Quality Assurance Control Process			
	Recording/Reporting mechanisms		
	Procedures for Non-compliance		
Responsibilities and Accountability			
Time Period			

INTEGRATED PEST MANAGEMENT (IPM) – INDOOR AND OUTDOOR

During the performance period have in place an Integrated Pest Management Plan for indoor and outdoor practices in line with requirements outlined below.

Integrated pest management (IPM) is a sustainable approach to managing pests by combining biological, cultural, physical and chemical tools in a way that minimizes economic, health, and environmental risks. IPM is site-specific in nature, with individual tactics determined by the particular crop/pest/environment scenario. The IPM approach places an emphasis on the reduction of pesticide use and the implementation of preventative and alternative control measures (Sustainable Sites Initiative 2009)

The plan has to outline clearly the IPM control methods that are to be employed on site to control unwanted pests in an integrated manner. Such IPM control methods may include[1]:

1. **biological control**: using predators, parasites or microbial pathogens to suppress pests
2. **cultural and physical control**: using methods such as barriers and traps; adjusting planting location or timing; or crop rotation and cultivation techniques which expose pests to predation or destroy their food, shelter and breeding habitats
3. **chemical control**: selecting *least toxic pesticides* and using them only when needed as opposed to regular preventative spraying
4. **plant choice**: choosing plant varieties that are resistant to diseases in an area, and matching species to the site
5. **pheromone control**: using pheromones to monitor insect populations in a crop or orchard.

[1] Extract from "Integrated Pest Management, New South Wales Environmental Protection Agency: http://www.epa.nsw.gov.au/pesticides/integratedpestmgmt.htm, accessed 18 July 2013

EB-ECO-1 Grounds-Keeping Practices

POINTS AVAILABLE 4

Integrated methods that make use of monitoring and non-toxic preventative measures (e.g., site inspection and maintenance, cultural controls, pest inspection, and population monitoring) must be used to manage and minimise pest issues proactively. Regular visual inspections must be conducted to monitor both the presence of pests and effectiveness of current preventative measures. In the event that monitoring activities reveal a need for the use of pest controls, appropriate control options will be evaluated and the least-toxic option will be employed. Many of the general preventative practices are simple housekeeping and landscaping procedures that eliminate sources of food, water and shelter that attract pests to the building grounds and interior. Preventative measures are both cost-effective and provide minimal risk to building occupants.

Integrated Pest Management (IPM) Plan

The IPM plan must be included or referenced in both the landscape and the hardscape maintenance plan and must, at a minimum include the following:

1. **IPM Programme**: Outline, stipulate and follow a four-tiered IPM programme
2. **Performance Metrics and Quality Control**: Specify performance measurement metrics and quality control systems that will evaluate the effectiveness of the IPM Plan.
3. **Least-Toxic Pesticides:** Stipulate the preferred use of nonchemical methods and least-toxic pesticides, and
4. **Building Occupant and User Communications Strategy:** Have in place a strategy for communications between the IPM team and the building occupants and require universal notification, including definition of emergency conditions

1. IPM Programme

The IPM plan must outline, stipulate and follow a four-tiered approach such as that developed Integrated Pest Management (IPM) Principles issued by the US Environmental Protection Agency and must consider the following elements:

1. Action Thresholds
2. Monitoring and Identification of Pests
3. Prevention
4. Control

2. Performance Metrics and Quality Control

Put in place a mechanism for documentation of inspection, monitoring, prevention, and control methods and for evaluation of the effectiveness of the IPM plan. Specify the metrics by which performance will be measured, and describe the quality assurance process to evaluate and verify successful implementation of the plan.

Implement the strategies set out in the IPM plan and evaluate the plan annually. This evaluation must verify that the strategies specified in the IPM plan have been implemented and identify any chemical applications that did not comply with the plan.

Perform recordkeeping and documentation required under the IPM plan. Maintain records all pesticide applications.

3. Least-toxic pesticides

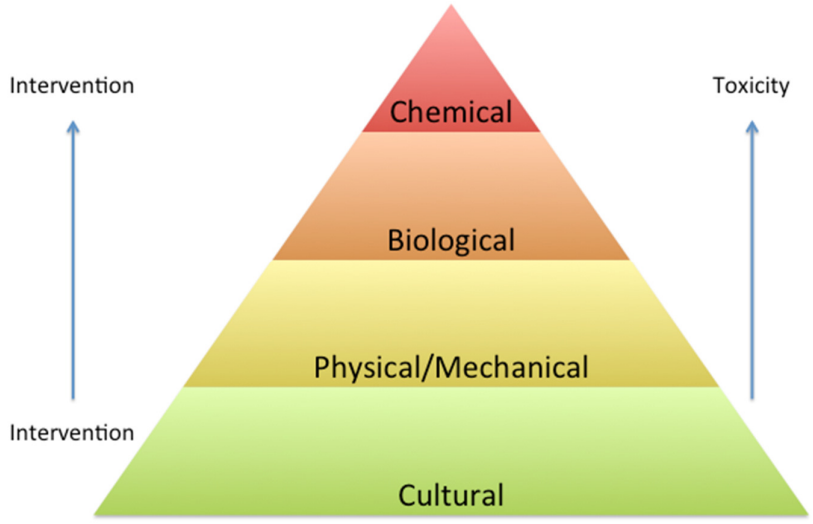
Least-toxic pesticides are here defined in accordance with the following:

1. Least toxic According to the new RSA classification system where products are labelled and colour coded as per the table below, and/or

2. GHS Category 4 in accordance with The WHO Recommended Classification of Pesticides by Hazard and Guidelines to Classification 2009 and/or
3. "Products Screened by the Integrated Pest Management Programme, City and County of San Francisco" Tier III criteria (least hazardous)[2]

Poison Group	Warning statements on container	Colour of band* around container
Group IA	Very toxic	RED
Group IB	Toxic	RED
Group II	Harmful	YELLOW
Group III	Caution	BLUE
Group IV	No warning statements	GREEN

Table: Group classification and warning statements on labels.



Pennsylvania State University 2011

4. Building Occupant and User Communications Strategy

Have in place a strategy for communications between the IPM team and the building occupants. This strategy may include education about the IPM plan, participation in problem solving, feedback mechanisms (e.g., a system for recording pest complaints), and provision for notification of pesticide applications.

At a minimum, the facility manager must notify any building occupant or employee who requests it and post a sign at the application site, which must remain in place for 24 hours. Notifications must include the pesticide name, registration number, treatment location, and date of application. Applications of least-risk pesticides do not require notification. For an emergency application of a

[2] http://www.sfenvironment.org/sites/default/files/fliers/files/sfe_th_products_screened_by_sfe_ipm.pdf

pesticide, anyone who requested notice must be notified within 24 hours of the application and given an explanation of the emergency.

Universal Notification

The IPM plan has to make provisions for a universal notification system, if a pesticide, other than a least-toxic pesticide as defined above, must be applied on site. This strategy requires the project owner/manager and its pest management contractors notify building occupants of a pesticide application at least 72 hours in advance under normal circumstances and no more than 24 hours after an emergency application. Notification must be made through posted signs or other means that ensure reaching 100% of occupants. This notification system will enable occupants and staff, including especially high-risk occupants such as children, pregnant women, the elderly, people with compromised immune systems and others, to modify their plans based on pesticide use at the building.

Notification must include the following:

- Pesticide product name
- Active ingredient
- Product label signal word (e.g., “caution”, “danger”)
- Time and location of application
- Contact information for persons seeking more information

Emergency Conditions

Emergency Conditions must be stipulated in the IPM Plan to allow for actions open to ground staff in the event of an emergency. Although an emergency may be defined differently from project to project building, an emergency may be defined as an event presenting circumstances in which ground staff deem it necessary that the immediate use of a specific pesticide is necessary to protect the health and safety of staff and other persons, or the project site. In this case, a pesticide may be applied at a project building without following the stipulations for use of integrated and least-toxic methods.

Below is a checklist (extracted from the Submission Template) outlining the required content of the Integrated Pest Management Plan.

Table 3: Checklist - Integrated Pest Management Plan

Integrated Pest Management Plan		**Included in Plan**	**Page number**
Purpose			
Scope			
Goals and Plan Rules			
Performance Metrics			
Procedures and Strategies			
IPM Programme			
	Action Thresholds		
	Monitoring and Identification of Pests		
	Prevention of Infestation		
	Pest Control		
	Least-Toxic Pesticides		

EB-ECO-1 Grounds-Keeping Practices

POINTS AVAILABLE 4

Building Occupant and User Communication Strategy	Strategy		
	Universal Notification		
	Emergency Conditions		
Quality Assurance Control Process			
	Documentation: inspection, monitoring, prevention, control		
	Recording/Reporting mechanisms		
	Procedures for Non-compliance		
Responsibilities and Accountability			
Time Period			

DOCUMENTATION REQUIREMENTS

Criteria	Documentation
All	• **Completed Submission Template**
Landscape Management	• **Copy of the Landscape Management Plan** Complete the checklist provided, confirming the contents of the Landscape Management Plan with page numbers. • **Signed Confirmation of Implementation** of the Plan during the performance period. Signed by responsible contractor, countersigned by the Facilities Manager.
	• Where applicable and required as per the credit, submit a copy of the **Ecological Policy**.
Hard Surfaces and Building Exterior Management Plan	• **Copy of the Hard Surfaces and Exterior Building Management Plan.** Complete the checklist provided, confirming the contents of the Hard Surfaces and Exterior Building Management Plan with page numbers. • **Signed Confirmation of Implementation** of the Plan during the performance period. Signed by responsible contractor, countersigned by the Facilities Manager.
Site Maintenance – Integrated Pest Management Plan	• **Copy of the Integrated Pest Management Plan.** Complete the checklist provided, confirming the contents of the Integrated Pest Management Plan with page numbers. • **Signed Confirmation of Implementation** of the Plan during the performance period. Signed by responsible contractor, countersigned by the Facilities Manager.

EB-ECO-1 Grounds-Keeping Practices

POINTS AVAILABLE 4

ADDITIONAL GUIDANCE / RESOURCES

Ecological Management

The following are examples of interventions that can be implemented in a phased manner with the aim of continuous improvement where the ecological value is enhanced beyond its previous existing status. It is understood that not all buildings and occupied sites will be in a position to implement all of these proposed interventions due to the location, character and size of the site. The ecological management interventions and quantification thereof should be specified in the Ecological Assessment and the Management Plan.

Examples of Interventions	Examples of Benefits
Clear invasive alien plants, especially in mountain catchments and riparian areas	Increased water yield and improved ecological functioning
Rehabilitate wetlands	Improved water quality through filtering of pollutants and toxins, regulating water flow, restoring aquatic biodiversity and biological functioning
Maintain buffers of natural vegetation along streams and rivers	Reduced flood damage, improved ecological/ biological system functioning; ecological corridors
Reinstate natural vegetation	Improved soil quality; floral and faunal diversity
Stabilise river banks and creation of wetlands	Reduced erosion and improved soil and water quality
Monitor compliance with effluent standards for agriculture and industry	Reduced sediment load in rivers
Indigenous and endemic planting	Improved biodiversity and creation of habitat resulting in natural pest control, pollination, seed dispersal etc.
Installation of eco-infrastructure such as owl houses, bat boxes, bird feeders and nesting logs, water features to enhance faunal diversity	Improved faunal species biodiversity and creation of habitat resulting in natural pest control, pollination, seed dispersal etc.

Source: adapted from SANBI, 2012

BACKGROUND

Although awareness of the value of natural open space within a developed matrix is growing, practical implementation of measures to protect, conserve and improve ecological space is still absent. Key shortcomings include inadequate resource allocation and failure to incorporate ecological performance into the operational objectives of developed sites. True recognition of the contribution that each and every site can make to the overall functioning of a broader ecological context lies in actively preserving existing ecological functioning and improving the ecological state over time irrespective of the size of the site or the nature of the open spaces present. Any landscape, whether office park, shopping mall, home office, or residential development, holds the potential both to improve and to regenerate the natural benefits and services provided by ecosystems. Just as recycling relies on the accumulation of individual recyclable items, so can ecological function be found in the establishment of a network of many smaller properly managed natural habitats.

It is, however, important for operators of developed sites to understand the existing and potential value that natural spaces on the site have, or can contribute to the immediate context. Through such an understanding, other maintenance and operational activities can be directed in a way that will enhance the ecological value of the site over time. This credit plays an integrative function, providing a focus for grounds-keeping and landscape management, and ensuring that the optimisation of open spaces form part of the management commitments.

The preservation and progressive improvement of open space and ecological function should not be seen as a process that only aims at benefitting the natural environment – a proper functioning ecology will translate into benefits to the owners and occupants of sites. Benefits include improved emotional health, cleaner air and water, higher productivity, improved microclimate, natural pest control and risk mitigation. Investment in ecological functioning is therefore also an investment in human health and well-being, and as a consequence, also the financial value of a developed site.

Conventional site and landscape maintenance practices can have adverse impacts on the surrounding environment and human health, which may involve the use of unsustainable volumes of potable water, harsh pesticides, noisy carbon emitting equipment, and potentially increasing grounds maintenance costs. Major areas for concern are usually found in the following:

1. Worker and building and site occupant safety and health can be severely compromised during and after application of conventional pesticides and fertilizers (see ECO-2).

2. Top soil loss (loss of organic matter), in particular as a result of erosion on developed sites, reducing the soil's overall ability to support plant life, regulate water flow and maintain the biodiversity of soil microbes and beneficial insects that control disease and pest outbreaks.

3. Where nutrients are lost, soil is compacted and biodiversity of soil organisms is decreased, this may necessitate the use of irrigation, fertilisers and pesticides, lead to increased stormwater runoff, and pollute groundwater and drinking water.

Alternative methods/ sustainable grounds keeping practices have the potential to lower operating costs, if carefully planned, managed and monitored.

Integrated Pest Management

In terms of Act-36 of 1947 the following is applicable:

- Remedies (Insecticides, Rodenticides, Fungicides, Herbicides, Acaricides, Molluscicides, Fumigants, IGR's and related formulations) must carry a South African Dept. of Agriculture Registration **(L-nnnn)**.
- Persons applying remedies and formulations in the business and public health space must carry a Dept. Agriculture Registration **(P-nnnn)**, as required under Act-36 of 1947.
    - **P**-Registration applies to natural person only.

Registered applicators (*operational persons*) are mandated to conduct activities within the requirements of the regulation under Act-36.

- Only registered remedies and formulations may be applied and calibrated in accordance with infestation risk and demand.
- Formulation and remedy must be determined in consideration with least risk, lowest possible environmental impact, and controlled application and management.
    - Remedies must also consider resistance tolerance applicable to the insect or target pest or Organism.

- Where possible, non-chemical interventions will be applied and also recommended, as is standard practice with an IPM (Integrated Pest Management) approach.
- A bottom up approach will apply to the following pesticide warning table:
- The application will be determined by the registration applicable to the relevant target pest or Organism.

Some remedies and formulations will not exist in the Green, Blue or Yellow classifications, thus necessitating an established application and methodology.

REFERENCES & FURTHER INFORMATION

Act No. 10 of 2004: National Environmental Management: Biodiversity Act, 2004

Act No. 107 of 1998: National Environmental Management Act, 1998

Department of Environment Affairs: http://www.environment.gov.za/

National Biodiversity Assessment (NBA), 2011

National Biodiversity Framework (NBF), 2009

National Biodiversity Strategy and Action Plan (NBSAP), 2005

New South Wales EPA Integrated Pest
http://www.environment.nsw.gov.au/pesticides/integratedpestmgmt.html

New South Wales EPA use of pesticides: http://www.environment.nsw.gov.au/pesticides/

South African Council for Professional Natural Scientists (SACNASP): http://www.sacnasp.org.za/

South African Council for the Landscape Architectural Profession (SACLAP):http://www.saclap.org.za/

South African National Biodiversity Institute (SANBI): http://www.sanbi.org/

South African National Standard, Globally Harmonized System of classification and labelling of chemicals (GHS), SANS 10234:2008.

The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009. Available at http://www.sustainablesites.org/report.

US EPA, Integrated Pest Management Principles: http://www.epa.gov/opp00001/factsheets/ipm.htm

USGBC, Leadership in Energy and Environmental Design (LEED) – Existing Buildings: Operations and Maintenance Reference Guide, 2009.

USGBC, Leadership in Energy and Environmental Design (LEED) – Existing Buildings: Operations and Maintenance Reference Guide, 2009.

http://www.facilitiesnet.com/groundsmanagement/article/Planting-the-Green-Seed--8935

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

EB-ECO-1 Grounds-Keeping Practices

POINTS AVAILABLE 4

EB-ECO-2 Community Facilities

POINTS AVAILABLE **1**

AIM OF CREDIT

To encourage and recognise integrated and shared land use and community development through the provision of on-site facilities for use by the local community.

CREDIT CRITERIA

Dedicated Facilities	**1 point is awarded where the project building / site provides at least one 'Community Facility' for access and benefit to the local community or public.**
OR	
Shared Facilities	**1 point is awarded where a facility within the building is actively utilised to allow part-time use for community or public benefit activities.**

Community Facilities

To be considered a 'Community Facility' in line with the aim of this credit, the facility must:

- Have a minimum Usable Area of 20m2 (unless stated otherwise in examples below)
- Be freely accessible to the relevant stakeholders of the local community
- Be provided free of profit by the landlord
- For 'Shared Facilities', a formal agreement for the use of the space must be in place throughout the performance period, and access must be provided for frequent use (min once per week).

Examples of 'Dedicated Facilities' may include, but are not limited to:

- A pre-primary 'nursery school' or crèche for small children
- Computer centre with Internet access
- Education, training facility or crèche for local communities
- Health facilities like a clinic
- Small business incubation centre or development hub
- Playground area
- Open landscaped area for active play (minimum area 200m^2)
- Outdoor gym / exercise
- Community market
- Recycling depot
- Community food garden

EB-ECO-2 Community Facilities

POINTS AVAILABLE **1**

Examples of 'Shared Facilities' may include, but are not limited to:

- Conference facility which is used as a training venue outside of normal operating hours
- Auditorium which is used for community meetings outside of normal operating hours
- Library or computer centre accessible to local school or community outside of normal operating hours
- On site outdoor facilities such as fields for active play or swimming pools accessible to local schools or community outside of normal operating hours

DOCUMENTATION REQUIREMENTS

Submit all the evidence and ensure it readily shows compliance,

Criteria	Documentation
All	• **Completed Submission Template**
Dedicated Facilities	• **Letter of Confirmation from Landlord** • **Evidence in the form of drawings / photographs**
Shared Facilities	• **Signed Agreement between Landlord and relevant user**

Letter of confirmation* from Landlord must include:

- A description of the dedicated community facility and its intended usage
- Confirmation of the size of the facility
- Confirmation of the community members who have access to the facility
- Confirmation of the access times

**Signed letter, facsimile or email with company email signature and date of issue*

Signed Agreement between Landlord & User must include:

- A description of the dedicated community facility and its intended usage
- Confirmation of the community members who have access to the facility
- Confirmation of the access times

ADDITIONAL GUIDANCE / RESOURCES

A community is defined as a group of residents who live, work or visit regularly in the immediate vicinity of the project, or it can also be another stakeholder group or groups relevant to this development, for example low-income workers such as the construction workers and the cleaners, security and maintenance staff who will work in the building.

EB-ECO-2 Community Facilities

POINTS AVAILABLE **1**

BACKGROUND

As the pressure on land becomes greater, with increased land values and less accessibility to the general public as a consequence, especially in urban areas, so opportunities for shared land use for local communities become more important. Projects catering for public assembly type activities offer a unique opportunity to promote the concept of shared land use by providing such community facilities thus encouraging neighborhoods with real character and a sense of place (CABE Space, 2005).

There is a growing body of evidence that demonstrates how communal green spaces can offer lasting economic, social, cultural and environmental benefits. These benefits include increasing the value of homes; improving the image of an area and attracting investment; contributing to the protection of biodiversity; and promoting exercise and other activities beneficial to the health of residents (CABE Space, 2005).

Outdoor community facilities are not only a good way to use the available space of a development in the most efficient way, but can contribute significantly to the well being, and sense of community experienced by local residents. Access to outdoor public facilities allows people to get first hand exposure to the natural systems as well as providing access to these amenities by foot. The more amenities offered within the open spaces that transverse cities and the more continuously these are linked, the more people will use them.

In 2004, the Commission for Architecture and the Built Environment (CABE) Space published 'The Value of Public Space', a collation of research that highlighted a wide range of benefits that outdoor communal facilities can offer. The contributions included:

- A Merseyside study that showed how the presence of trees and green spaces can make places pleasantly cooler in summer and reduce surface water run-off;
- Findings showing that community gardens and urban farms increase social inclusion by providing opportunities for interaction; and
- Conclusions suggesting that providing multiple types of outdoor facilities can help to stimulate different kinds of activity in the shared space throughout the day. For example, it is important to provide many different activity zones within parks for both active and passive uses, in order to encourage use by as diverse a range of people as possible.

Design plays a large part in whether a space feels private, communal or public. The distinction between public and private can be indicated by boundaries, such as fences and walls; planting, such as hedges or trees; water features; changes in surface treatment; planting; or the design and orientation of buildings (CABE Space, 2005).

REFERENCES & FURTHER INFORMATION

Green Building Council of Australia. (2009) 'Technical Manual Green Star Public & Education Building version 1.

Commission for Architecture and the Built Environment (CABE) Space (2005), 'Start with the park', England. **http://www.cabe.org.uk**

Woolley, H. and Rose, S. (2004), 'The Value of Public Space: How High Quality Parks and Public Spaces Create Economic, Social and Environmental Value', Commission for Architecture and the Built Environment (CABE) Space. **http://www.cabe.org.uk/default.aspx?contentitemid=475**

Todeschini, F. & Dewar, D. (s.a). The Street as Pre-requisite Open Space: Current South African Settlement Practice and the Need for a Paradigm Shift Fabio, School of Architecture, Planning and Geomatics, University of Cape Town

Todeschini, F. & Dewar, D (2004) Chapter 5 in Rethinking Urban Transport After Modernism. Ashgate Publishing Company, Aldershot.

Swilling, M.(ed) Sustaining Cape Town: Imagining a livable city, Sun MeDIA, Stellenbosch: 2010

Fair Play for Children NGO, **www.fairplayforchildren.org**

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

EB-EMI-1 Refrigerants

POINTS AVAILABLE **2**

AIM OF CREDIT

To encourage operational practices that minimise the environmental impacts of refrigeration equipment.

CREDIT CRITERIA

Gradual replacement policy	**0.5 points** are awarded if a gradual replacement policy and plan is in place to replace all non-zero ODP refrigerants (or equipment).
Refrigerants Impacts	**0.5 points** are awarded where at least 80% of total refrigerant mass serving the building is made up of zero ozone depletion potential (ODP) refrigerants. **An additional 0.5 points** are awarded if the remaining or all of the refrigerant mass is subject to leak auditing or leak testing OR 100% of total refrigerant mass serving the building is made up of zero ozone depletion potential (ODP) refrigerants. **An additional 0.5 points** are awarded where at least 50% of the total refrigerant mass serving the building is made up of low (<10) global warming potential (GWP) refrigerants.

Where no refrigerants are used in the building, both points above are awarded.

DOCUMENTATION REQUIREMENTS

Criteria	**Documentation**
All	• **Completed Submission Template**

Gradual replacement policy	• **Gradual Replacement Policy** containing the following
	  o Policy
	  o Schedule of equipment using high ODP refrigerants complete with mass of refrigerant, age of equipment and planned phase out or replacement date.

Refrigerants Impacts	• **Schedule of all Equipment** in the building using refrigerant including
	  o Calculated percentage of mass of zero ODP vs total mass of refrigerant.
	  o Calculated percentage of mass of low GWP vs total mass of refrigerant (if applicable).
	• **Logging Results of Leak Auditing,** or
	• **Proof of Leak Testing,** or
	• **Proof of Leak Detection System**
	For all non-zero ODP refrigerant equipment with mass more then 3kg refrigerant. (unless 100% zero ODP)

EB-EMI-1 Refrigerants

POINTS AVAILABLE **2**

Areas not under control of Building Management	• **Tenant Guidelines** Copy of issued guidelines detailing: o Recommendations for planning the replacement of non-zero ODP refrigerant systems o Recommendations for refrigerant leak auditing and testing procedures.
Areas Not Under The Control Of Building Management	The criteria set out within this credit applies to the refrigeration installations that are specified by and under the control of the building management team (as set out within the lease agreement). For refrigeration installations that are not specified by and under the control of the building management team, a tenant guideline document* must be issued which details the following: • Recommendations for planning the replacement of non-zero ODP refrigerant systems • Recommendations for refrigerant leak auditing and testing procedures. **Note that projects may choose to include the required tenant guidelines in the Building User Guide as per Man-3 Building Management."*

The scope of this credit includes air conditioning systems and building services refrigeration equipment. Appliances are not the focus of these criteria and are excluded from this credit.

GRADUAL REPLACEMENT POLICY

A policy shall be in place that supports a gradual replacement programme as well as monitoring and maintaining leaks.

As a result of this policy, a plan shall be in place including as a minimum the following in order to be compliant.

- Perform an audit of the systems using refrigerants
- Prepare a schedule of equipment, complete with date of planned replacement of each system not yet zero ODP.
- Ensure that on replacement, removed refrigerant is contained and not released to the atmosphere.

REFRIGERANT IMPACTS

Prepare a schedule of all equipment in the building using refrigerant and calculate the percentage mass of low ODP (or if targeted low GWP) vs the total mass of refrigerant in the building.

A process shall be in place to either monitor the use of refrigerant and keep logs of the refrigerant purchased or periodically inspect and test refrigeration systems to identify any possible leaks and repair them as soon as possible. One of the following three options can be followed.

Option 1: Leak auditing – logging results

a. Log refrigerant use.

b. Records shall be kept in terms of refrigeration volume purchases during re-gassing, repairs and replacement of equipment in order to calculate any losses that may be due to leakages.

    i. Total Refrigerant Charge

    ii. Refrigerant additions to the system

    iii. Refrigerant removals from the system

c. Calculated losses.

Option 2: Leak test the systems at least once per year. The leak tests shall include basic visual inspection by a qualified technician and include the following

a. Standing leak tests

b. Oil residue checks

c. Test evaporator section leaks

d. Test condenser section leaks

e. Suction or liquid line leaks

Option 3: As an alternative to annual leak tests performed, an automatic leak detection system can be in place. This system is to have the following in place

a. Appropriately positioned refrigerant detectors depending on the type of refrigerant detected.

b. An electronic monitoring unit connected to a BMS or alarm system that will provide a signal when one of the detectors picks up a leak signal.

EB-EMI-1 Refrigerants

POINTS AVAILABLE **2**

ADDITIONAL GUIDANCE / RESOURCES

The table below provides ODP & GWP levels for some commonly used refrigerants and gasses.

For the purposes of this credit ODP levels should be zero and if targeted GWP levels should be below 10.

Refrigerant/Gas	Global Warming Potential (GWP100)	Ozone Depletion Potential (ODP)
R11	4000	1.0
R12	8500	0.83
R22	1700	0.05
R134a	1300	0
R407c	1600	0
R410a	1900	0
R290 (propane)	3	0
R600 (butane)	3	0
R1270 (propene)	3	0
Ammonia	<1	0
Halon 1211	1300	3
HFC227ea (FM200)	2900	0
IG541	0	0
CO_2	1	0
Air	0	0
Water	<1	0

Table Emi-1.1: *ODP & GWP of some common refrigerants and gases*

EB-EMI-1 Refrigerants

POINTS AVAILABLE **2**

Examples of refrigerant logs can be found on

http://www.realskillseurope.eu/real-skills-europe-toolbox

The example below is for additions and removals of refrigerants per system in order to calculate net loss.

Additions and Removals of Refrigerants:						
Date (dd/mm/yy)	**Technician/ Company**	**Amount Added (kg)**	**Amount Removed (kg)**	**Net Loss (kg)**	**Type of Repair**	**Reason for Addition or Removal (note faulty components and record repair actions or what was done with recovered refrigerant)**
05/11/2005	Tech 1/ RSE	18.0	13.5	4.5	Minor	Condenser leak (faulty brazed joint) Repaired. Refrigerant re-used
18/03/2007	Tech 1/ RSE	4.0		4.0	Minor	Leaking flare joint - tightened to correct torque
09/08/2007	Tech 2/ RSE	22.0	5.0	17.0	Major	Compressor housing cracked - replaced compressor
05/03/2009	Tech 1/ RSE	1.4		1.4	Minor	Leaking Schrader valve (missing cap). Core tightened and capped.
06/09/2010	Tech 2/ RSE	0.3		0.3	Minor	PRV replaced during routine leak test
16/02/2011	Tech 3/ RSE	4.7	2.1	2.6	Minor	Faulty Service valve (leaky gland). Replaced

BACKGROUND

Refrigerant impacts on Ozone Depletion Building services have an impact on the amount of damage done to the ozone layer from Chlorofluorocarbons (CFCs) and Hydrochloroflourocarbons (HCFCs). These substances are used as refrigerants and in some insulation materials. These substances have been known to cause long-term damage to the Earth's stratospheric ozone layer, exposing living organisms to harmful radiation from the sun. They also have significant global warming potentials and contribute to global warming.

The ODP data provides a measure of the potential for damage that a chemical has relative to that of the refrigerant type CFC11. CFC11 has an ODP of 1 and is the most damaging of the CFCs. The ODP is defined as the total change in ozone, per unit mass, when the substance has reached a steady state in the atmosphere.

HCFCs are ozone-depleting but have a much lower ozone depletion potential than CFCs, and are considered a transitional chemical to aid the CFC phase out. They are commonly used as refrigerants, solvents, and blowing agents for plastic foam manufacture, and are scheduled to be completely phased out by 2030 according to the US Environmental Protection Agency and the Montreal Protocol.

Refrigerant impacts on Global Warming

The 100-year Global Warming Potential is considered for the purpose of the Green Star SA Existing Building Performance rating tool. The GWP provides a measure of the potential for damage that a chemical has relative to 1 unit of Carbon Dioxide. GWP is used to describe Global Warming Potential over 100 years; and is used by the UN International Panel on Climate Change (IPCC).

EB-EMI-1 Refrigerants

POINTS AVAILABLE **2**

The use of Chlorofluorocarbons (CFCs) and Hydrochloroflourocarbons (HCFCs) as refrigerants has been addressed under the International Montreal Protocol, and subsequent phase-out programs have resulted in the removal of these substances from the market. However, the replacements currently favoured by the industry are Hydro fluorocarbons (HFCs) which have a high global warming potential (GWP).

The GWP provides a measure of the potential for damage that a chemical has relative to one unit of Carbon Dioxide, the primary greenhouse gas. Figures in excess of 3000 times are not uncommon amongst some refrigerants currently specified. Their long half-life is a major contributory facto in this.

Hydrocarbons and ammonia-based refrigerants have low or zero GWP. As such they are preferable long-term options. These refrigerants are gradually becoming available and are valid alternatives to HFCs.

Note that using Ammonia refrigerant, a Health and Safety risk assessment should be carried out since it is corrosive and hazardous if released in large quantities. However, due to its pungent smell, leaks are normally detected before they reach hazardous concentrations.

Refrigerant impacts on leak management

It is common practice during maintenance of HVAC systems containing refrigerants to dispose of the refrigerants in the system, where an automatic system of refrigerant containments is not included in the system design. This large release of refrigerants to the atmosphere can cause significant environmental damage, particularly is the refrigerants have a high ozone depletion or global warming potential.

REFERENCES

- Green Star South Africa, Public & Education Building v1, https://www.gbcsa.org.za/knowledge/publications/?cat=98
- LEED EBOM, 2009 Edition, http://www.usgbc.org/resources/leed-ebom-2009-reference-guide-supplement-europe-acps-global-acp
- Green Star Australia, Green Star Performance, https://www.gbca.org.au/green-star/green-star-performance/
- UK, Department for Environment, Food and Rural Affairs, General Guidance, Guidance: F Gas and Ozone Regulations, Information Sheet GEN 5: Refrigerant Quantity, April 2012, https://www.gov.uk/managing-fluorinated-gases-and-ozone-depleting-substances
- REAL Skills Europe F-Gas Log and Carbon Emissions Calculator Software tool, http://www.realskillseurope.eu/

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

EB-EMI-2 Legionella

POINTS AVAILABLE 1

AIM OF CREDIT

To recognise and encourage implementation and utilisation of a water management process with intention to minimize risks associated with Legionnaires' disease.

CREDIT CRITERIA

Risk Management	**0.5 points** are awarded where there is a process to manage overall risk presented by Legionnaires' disease during the performance period. Furthermore, it should be demonstrated that such a risk management process is monitored and reviewed regularly as per SANS 893 Part 1.
Control of Legionella in water systems	**0.5 points** are awarded where there is an effective programme for treatment and control of Legionnaires' disease in water systems during the performance period as per SANS 893 Part 2.

The first action is to conduct "Risk identification" as described in SANS 893:2013 Edition 1 Part 1 *Risk Assessment*. Only if there is no risks identified can this credit be deemed as "Not Applicable". If any possible risk areas are identified the credit applies.

To comply with the requirements of this credit, the building owner must:

1. Implement a plan to manage risks associated with Legionnaires' disease within the premises. The risk management plan must address at least, the following categories:
    a. Communication and consultation
    b. Risk identification
    c. Risk analysis
    d. Risk evaluation
    e. Risk treatment
    f. Risk monitoring and review
2. Ensure that a programme for the control of Legionella in water systems is established during the performance period and implemented. For compliance with this credit, the programme must address the following:
    a. Water system design
    b. Water system commissioning or re-commissioning
    c. Operation
    d. Maintenance

EB-EMI-2 Legionella

POINTS AVAILABLE 1

DOCUMENTATION REQUIREMENTS

Criteria	Documentation
All	• **Completed Submission Template** incorporating a checklist which indicates compliance with the risk matrix plan and treatment programme, accompanied by the following documents:
Risk Management	• **Risk management plan** document, that complies with the South African National Standard - SANS 893:2013 Edition 1 Part 1 Risk Assessment (Legionnaires' disease)
Control of Legionella	• **Implementation programme for the treatment and control** of Legionnaires' disease which complies with the South African National Standard - SANS 893:2013 Edition 1 Part 2 *The Control of Legionella in water systems*.
If Claimed 'Not Applicable'	• **Risk Assessment Report** confirming that no risks are identified.

ADDITIONAL GUIDANCE / RESOURCES

Further guidance on ways to reduce the risk and prevalence of Legionella, can be found in the South African Bureau of Standards' SANS 893 Part 1 and 2 published in May 2013.

Managing Legionella in Hot and Cold Water Systems

What needs to be done:

Building owners should carry out a full risk assessment of their hot and cold water systems and ensure adequate measures are in place to control the risks.

Using temperature control

The primary method used to control the risk from Legionella is water temperature control.
Water services should be operated at temperatures that prevent Legionella growth:

- Hot water storage cylinders (calorifiers) should store water at 60°C or higher
- Hot water should be distributed at 50°C or higher (thermostatic mixer valves need to be fitted as close as possible to outlets, where a scald risk is identified).
- Cold water should be stored and distributed below 20°C.

A competent person should routinely check, inspect and clean the system, in accordance with the risk assessment.

Identify 'sentinel' outlets (furthest and closest to each tank or cylinder) for monthly checking of the distribution temperatures. Check the hot water storage cylinder temperatures every month and cold water tank temperatures at least every six months.

Stagnant water favours Legionella growth. To reduce the risk, remove dead legs/dead ends in pipe-work, flush out infrequently used outlets (including showerheads and taps) at least weekly and clean and de-scale shower heads and hoses at least quarterly. Cold-water storage tanks should be cleaned periodically and water should be drained from hot water cylinders to check for debris or signs of corrosion.

Design systems to minimise Legionella growth, by:

- keeping pipe work as short and direct as possible;
- adequately insulating pipes and tanks;
- using materials that do not encourage the growth of Legionella;
- preventing contamination, e.g. by fitting tanks with lids and insect screens.

Additional controls

Water samples should be analysed for Legionella periodically to demonstrate that bacteria counts are acceptable. The frequency should be determined by level of risk, in accordance with the risk assessment.

Other control methods

Other methods to control Legionella include copper and silver ionisation and biocide treatments (eg chlorine dioxide). To ensure that they remain effective their application will need suitable assessment as part of the overall water treatment programme including proper installation, maintenance and monitoring

Adapted from (Source): Health and Safety Executive, http://www.hse.gov.uk

BACKGROUND

Legionnaires' disease is a common name for one of the several illnesses caused by Legionnaires' disease bacteria (LDB). Legionnaires' disease is an infection of the lungs and is a form of pneumonia. More than 43 species of Legionella have been identified and more than 20 linked with human diseases. Legionellosis is the term for the diseases produced by LDB. In addition to Legionnaires' disease, the same bacteria also cause a flu-like disease called Pontiac fever. – Extracted for the Website (www.osha.gov) of the United States Department of Labour, Occupational Health and Safety Administration

The World Health Organisation's report titled "Legionella and the prevention of Legionellosis" makes the following statement:

EB-EMI-2 Legionella

POINTS AVAILABLE 1

"According to published research, up to 70 percent of all building water systems are contaminated with Legionella, the bacteria that cause Legionnaires' disease - a serious but preventable form of pneumonia, as well as Pontiac Fever, a flu-like illness, which recently sickened more than 200 people as a result of the widely reported outbreak at the Playboy mansion. Together, these diseases are called Legionellosis.

Occupants in your buildings can become ill when they ingest or inhale water or aerosols contaminated with Legionella. In a health care setting, it can also be transmitted through respiratory devices. Although anyone at any age can contract Legionellosis, the people most at risk are smokers, the elderly, and individuals with impaired immune systems."

In South Africa, there is no source with statistical data to indicate the prevalence of Legionellosis. However, there has been isolated reports of the Legionellosis cases in the hospitality and mining industries, which suggests that there is need for better prevention and control the this disease.

REFERENCES & FURTHER INFORMATION

Guidelines for the control of Legionella in Manufactured Water Systems in South Australia, 2008 (Revised 2013)

South African Standard SANS 893:2013 Part 1 & 2 (Legionnaires' disease, Risk Management and The Control of Legionella in water systems)

South African National Standards SANS-241 (Drinking water)

ASHRAE Standard Project Committee 188 (SPC 188): Prevention of Legionellosis Associated with Building Water Systems

World Health Organisation report titled "Legionella and the Prevention of Legionellosis, 2007"

Health and Safety Executive, http://www.hse.gov.uk

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

EB-EMI-3 Storm Water

POINTS AVAILABLE **1.5**

AIM OF CREDIT

To recognize site-related practices which limit the disruption of natural hydrology, minimize pollution and site deterioration.

CREDIT CRITERIA

Storm Water Management	0.5 points are awarded if a Storm Water Run-Off Management plan is compiled which ensures that the site and hard surfaces are managed to control storm water runoff and filter litter or pollutants to reduce peak flows, erosion and contamination of ground water, streams and rivers. 0.5 points are awarded If the above Management Plan is implemented during the performance period and an annual inspection program of all storm water facilities to confirm continued performance, was undertaken. Peak storm water flows must be calculated and disclosed for the performance period and required maintenance that was assessed must be implemented.
Storm Water Run-off Reduction	0.5 additional points are awarded when the following strategies for reducing storm water run-off are applied: • Introduction of landscaping and pervious hard surfaces reducing hardscaping by 15%, or • ~~retrofitting~~Retrofitting permeable features at appropriate points along the storm water flow path to allow groundwater recharge or harvesting of precipitation for re-use.

The 'Storm Water Run-off Reduction' portion of the credit is **'Not Applicable'** to areas where the ground conditions are such that infiltration needs to be avoided because of dolomite or similar conditions which can promote the formation of sinkholes

STORM WATER MANAGEMENT PLAN:

During the performance period, implement a storm water management plan that identifies:

- Built environment and natural environmental elements with their ~~assocoiated~~associated constraints and problems.
- On-going operational targets- short term solutions and longer term solution to be implemented over a few years.
- Issues and causes of peak flows, erosion, pollution etc.
- Implementation of source control thereby reducing the generation of increased run-off
- Implementation of repairs, maintenance and stabilization

STORM WATER INSPECTION PROGRAMME:

The owner must implement an annual inspection program of all storm water management facilities to confirm continued performance.

EB-EMI-3 Storm Water

POINTS AVAILABLE **1.5**

Maintain documentation of inspection, including identification of filtration and attenuation as well as areas of erosion, maintenance needs and repairs. Perform all routine required maintenance, necessary repairs or stabilization within 60 days of inspection.

Calculation and disclosure of peak flows:
A site plan indicating the following will be required:

- Building and all hard surfaces/paving and driveways,
- Storm water flow path over hard surface areas and collection points identified are to be marked up on the plan.

A data-set of precipitation time and volumes for a percentile storm related to specific location is required which can be obtained from the Water Research Commission see references and further information.

Run-off calculations by simplified methods can be obtained in the Drainage manual of SANRAL, (see references)

DOCUMENTATION REQUIREMENTS

Submit all evidence and ensure it readily confirms compliance.	
Criteria	**Documentation**
All	**Completed Submission Template**
Storm Water Management Plan	**Storm Water Management Plan** that ensures that the site and hard surfaces are managed to control storm water runoff as well as to filter pollutants/litter to reduce erosion ~~and eliminate~~and eliminate contamination. **Storm Water Inspection Report**: Inspection report confirming storm water systems are operating as intended, including site plan and storm water layout with table of calculations that shows how peak storm water flows were determined and disclosed for the performance period.
Storm Water Run-Off Reduction	**Short report** with referenced site plan showing extent of reduction and appended photos to verify before end after scenarios. 'As built' site plan to show extent of site hard surfaces, flow-paths and introduction of permeable features. Show that strategy been applied to: • Reduce the hard surface areas by landscaping and pervious hard surfaces for at least 15% of the areas with a maximum threshold of 50% (projects with less than 50% hardscaping achieve this point), or • Retrofitting permeable features at appropriate points along the storm water flow path to allow groundwater recharge or harvesting of precipitation for re-use

	Where points are claimed 'not applicable' provide signed confirmation from building manager or facilities manager/building owner that ground conditions are such that infiltration needs to be avoided.

ADDITIONAL GUIDANCE / RESOURCES

To limit disruption of natural hydrology by reducing impervious cover, increasing on-site Infiltration, reducing or eliminating pollution from storm water runoff and eliminating contaminants, the following could be practical sequencing of interventions:

- Firstly, preserve and restore elements of Storm water System: natural channels, eroded vegetation embankments
- Secondly manage the quantity and quality of storm water near the source
- Thirdly install new treatment measures or rainwater harvesting-, attenuation-, filtration- or other systems as intervention retrofits.

Properly managed storm water flows can prevent the increase in flood risk and watercourse erosion typically caused by urbanisation and provides important flow return to streams, offsetting the environmental impact of upstream water supply diversions and reducing the need for costly in-ground storm water infrastructure.

The following additional storm water management interventions could have further benefits to the building's environmental impact:

- Water reclamation/ rainwater harvesting can reduce potable water demand considerably;
- Soak-away comprises of an underground storage area packed with course aggregate or other porous media that gradually discharges storm water to the surrounding soil. Multiple soak-away elements can be put in the flow-path of peak run-off.
- The enhanced use of natural drainage corridors and depressions can provide open space, landscaped and recreational areas and conservation benefits increasing the amenity of new urban developments (multiple use corridors)
- Treatment of storm water closer to source minimises uncontrolled discharge of water containing high suspended solids, nutrients and organic material
- Grids to screen reception of storm water to filter rubble or litter or plastic shopping bags from the storm water system
- Permeable paving materials, such as porous asphalt or porous concrete, or modular paving blocks with openings filled with grass or gravel are surfaces that mimic natural infiltration.
- Infiltration trenches are excavated trenches filled with rock or relative large granular material and can be effective in removing sediment, metals, bacteria and organic material.

Permeable surfaces can also be designed with a turf cell reinforcement structure or open-celled pavers, and concrete or plastic grids with voids that are filled with topsoil, growing medium or aggregate to ensure that vehicle or foot traffic can still use the area securely whilst surfaces remain permeable.

Landscaping also plays an integral role in the design of most storm water treatment systems, offering opportunities for their aesthetic incorporation in the surrounding area. The use of particular plants species is important since some species will be more effective in treating storm water and better suited for surviving the ambient conditions. Co-ordination between storm water engineers, landscapers and nurseries/growers is advised to ensure that the required plants are available for planting at the correct stage in the season and during the performance period.

BACKGROUND

Storm water in practice is channelled away from sites as rapidly as possible to the nearest watercourse, wetland or coastline without much consideration for quality.

The necessity to deal with both the quantity and quality of runoff is recognised through the encouragement of groundwater recharge through infiltration, and for storage and reuse of runoff.

Storm Water quantity
From an ecosystem perspective it is the high frequency of smaller floods that cause the most cumulative damage. In its natural state, a landscape will absorb the rainfall from normal rainfall and minor storm events but during heavier or longer rainfall events the rainwater begins to soak into the soil. In undeveloped natural areas the amount of rainfall that will soak into the soil depends on how deep it is and its absorption capacity (clay to sandy).

Some water in the soil will be drawn up and lost through evaporation and the return of moisture to the air through evaporation from the soil and transpiration by plants. The remaining water will continue to seep into the water table. The ground water, once it reaches an impermeable layer, will slowly and continuously discharges into the watercourse. The vegetation along the watercourses which protects the soil against erosion has adapted to these conditions. Only after a number of showers in close succession or a period of extended rainfall will the soil reach saturation point and excess rainfall move across the surface as runoff.

The surface runoff is constantly dispersed and the energy dissipated by the vegetation cover until it reaches the watercourse or wetland. Damage to vegetation on the slopes and along the water course is usually limited and can recover between excessive storm events. In natural conditions it is normally only the infrequent large flood events that cause extensive damage to vegetation and soil. The vegetation recovers in the years between these events.

In developed areas however, the scenario changes: rainfall is collected on impervious surfaces, roofs, roads and parking areas and immediately concentrated into storm water pipes or surface channels. There is no vegetation to absorb the light showers, the surface is impermeable and there is no infiltration into the soil. Runoff is channelled to the nearest watercourse in a concentrated stream of high energy water. This means that every rainfall event results in a flood which results in damage to vegetation along the watercourse and soil erosion. Since every rainfall event results in a damaging flood within the watercourse there is no time for vegetation to recover and it is systematically removed and the exposed soil eroded.

Storm Water quality

The contaminants mostly found in storm water can be grouped according to their water quality impacts:

- **Oils, grease and surfactants:** Rubber from tyres and oil and grease washed from road surfaces, domestic and industrial sites, plus surfactants from detergents used for washing vehicles, materials or surfaces are common sources of toxic pollutants in storm water.
- **Litter:** This includes organic waste matter, paper, cigarette buds, plastics, glass, metal and other packaging materials from paved areas in urban catchments.
- **Total Suspended solids:** Suspended solids have two main constituents: organic, primarily from sewage, and inorganic, primarily from surface runoff. Turbidity from suspended solids reduces light penetration in water, affecting the growth of aquatic plants. When silts and clays settle, they may smother bottom dwelling organisms and disrupt their habitats. Since metals, phosphorus and various organics are adsorbed and transported with these particles, sediment deposits may lead to a slow release of toxins and nutrients in the waterway.
- **Nutrients:** Potential sources of nutrients are:
  – Sewage overflows;
  – Industrial discharges;
  – Animal wastes;
  – Fertilisers;
  – Domestic detergents; and
  – Septic tank seepage.

Excessive amounts of nutrients, such as nitrogen and phosphorous, can promote rapid growth of aquatic plants, including toxic and non-toxic algae. This excessive growth and oxygen depletion can cause fish and aquatic organisms to die.

- **Oxygen demanding materials:** Sources of oxygen-demanding materials are biodegradable organic debris, such as decomposing food and garden wastes, and the organic material contained in sewerage. Biological and chemical oxygen-depleting substances can cause water-borne diseases and present serious health risks.

Additional Guidance Sources:
Georgia Storm water Management Manual PDF (2001)
http://www.georgiastormwater.org
Idaho Department of Environmental Quality (2005), Catalogue of Storm water Best Management Practices for Idaho Cities and Counties
http://www.deq.idaho.gov
Nonpoint Education for Municipal Officials Delaware USA-Managing Storm Water
http://nemo.udel.edu/manual/.pdf

REFERENCES & FURTHER INFORMATION

The South African Guidelines for Sustainable Drainage Systems, Water Research Commission WRC Report TT 558/13, 2013
http://www.wrc.org.za/Knowledge%20Hub%20Documents/Research%20Reports/TT%20558-13.pdf
SANRAL-Drainage Manual 5th Edition.-The South African Roads Agency Ltd. Pretoria-2006
http://www.nra.co.za/content/Drain5.pdf
SANS 1200: LE 1982 Storm water Drainage – Standardized Specification for Civil Engineering Works, SABS Technical, 1982
http://www.sabs.co.za

Department of Water and Environmental Affairs (Water Quality)
http://www.dwaf.gov.za/Dir_WQM/default.asp
CSIR (2000), Guidelines for Human Settlement Planning and Design, Chapter 6, Storm water Management **http://www.csir.co.za/Built_environment/RedBook/**
Department of Environment and Water Resources (2002), Introduction to Urban Storm water Management in Australia. Canberra.
http://www.environment.gov.au/coasts/publications/stormwater/pubs/stormwater.pdf

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

EB-INN-1 Innovative Strategies and Technologies

POINTS AVAILABLE 10

AIM OF CREDIT

This credit is to encourage and recognise pioneering initiatives, processes or strategies in sustainable building management and operations.

CREDIT CRITERIA

Up to two points are awarded for an innovation initiative where:

- The initiative improving environmental performance is a technology or process that is considered a 'first' or 'early adopter' in South Africa or in the World;

OR

- The initiative substantially contributes to the broader market transformation towards sustainable development in South Africa or in the World.

Points are awarded as follows:

- One point is awarded when either of the above is true for the South African market;

OR

- Two points are awarded when either of the above is true for the Global market

Up to ten innovation initiatives can be awarded points under this credit, but no individual initiative can achieve more than two points in this credit. Qualifying initiatives may achieve additional points in other Innovation Credits, however the maximum points available for any one building assessment under Inn-1, Inn-2 and Inn-3 is ten (in total).

Where projects target the initiative as a 'first' or 'early adopter' the first 10 (ten) Green Star SA – Existing Building Performance projects applying that initiative will be permitted to be awarded innovation points. Refer to the GBCSA's innovation register on their website to see whether an innovation initiative has reached its capacity of 10 projects under a certain rating tool (www.gbcsa.org.za).

EB-INN-1 Innovative Strategies and Technologies

POINTS AVAILABLE 10

DOCUMENTATION REQUIREMENTS

Green Star SA – Existing Building Performance
Submit all the evidence and ensure it readily confirms compliance.
1. Short report

Short report prepared by a suitably qualified individual which describes how the Credit Criteria have been met by:

- Including a detailed description of each innovation initiative;
- Articulating the nature and magnitude of the environmental benefit achieved by the initiative(s);
- Referencing evidence and calculations, wherever appropriate, that supports all claims.
- Including any evidence necessary to demonstrate that the innovation claimed is first, or an 'early adopter' in the world or in South Africa (must be in the form of extracts from a peer-reviewed publication, letter from independent association/organisation or other research acknowledgement).

Page limit of Short Report per innovation initiative targeted: the maximum allowed number of pages that will be permitted will be 20 pages (including all supporting documents)

ADDITIONAL GUIDANCE

Innovation points are reviewed and awarded entirely at the discretion of the GBCSA, and any decision is final.

An Innovation submission must be a concise report that clearly articulates the nature and magnitude of the environmental benefit achieved by proposed initiative(s). The report must distinctly justify and quantify the environmental or advocacy benefits of the initiative. Submissions that are purely qualitative or unsupported by documented data related to the specific initiative will not be awarded Innovation points, regardless of innovative the initiative is.

In reviewing the submission, the GBCSA will consider the environmental benefit of the innovative initiative relative to existing Green Star SA – Existing Building Performance credits where relevant.

The metric used to demonstrate environmental benefit must, where possible, be the same as the metrics used in Green Star SA for similar attributes.

Information provided within the Innovation Credit applications may be used by the GBCSA to review the existing credits and/or develop new credits.

EB-INN-1 Innovative Strategies and Technologies

POINTS AVAILABLE 10

BACKGROUND

Green Star SA consists of categories, credits and benchmarks for various green building aspects that acknowledge integrated sustainable design/construction/operation - buildings are however complex and dynamic systems, and thus it is impossible for Green Star SA to address everything possible in the rating tools that always adequately rewards projects for innovative design, construction and operation. For this reason the Innovation category exists to allow projects to be rewarded and recognised for initiatives that are either beyond current Green Star SA benchmarks or not covered within the relevant rating tool.

The GBCSA encourages projects to go beyond what Green Star SA requires, to think 'out the box' in terms of sustainable design, construction and operation in the built environment, and the GBCSA will reward and recognise projects that do so, and are able to document the initiative appropriately.

REFERENCES & FURTHER INFORMATION

The Building Research Establishment Innovation Den
http://www.bre.co.uk/innovationden

The South African Government Department of Environmental Affairs & Tourism
http://www.environment.gov.za

The South African Government Department of Science & Technology (Research & Development Tax incentives)
http://www.dst.gov.za/r-d

The Council for Scientific & Industrial Research
http://www.csir.co.za/Built_environment/

Earthlife Africa
http://www.earthlife.org.za/

The Sustainable Energy Society Southern Africa
http://www.sessa.org.za/

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

EB-INN-2 Exceeding Green Star SA Benchmarks

POINTS AVAILABLE 10

AIM OF CREDIT

To encourage and recognise projects which achieve environmental benefits in excess of the current Green Star SA benchmarks.

CREDIT CRITERIA

Up to two points are awarded where there has been a substantial improvement on an existing Green Star SA credit, as follows:

- One point for a solution that results in the elimination of the specific negative environmental impact of the project targeted by an existing credit; and
- Two points for a solution that results in a substantial (e.g. 5% or greater above 'neutral') restorative environmental impact targeted by an existing credit.

Refer to the table in Additional Guidance to see for which Green Star SA credits these innovation points can be targeted, and what the required thresholds are for the relevant credits.

Up to ten innovation initiatives can be awarded points under this credit, but no individual initiative can achieve more than two points in this credit. Qualifying initiatives may achieve additional points in other Innovation Credits, however the maximum points available for any one building assessment under Inn-1, Inn-2 and Inn-3 is ten (in total).

DOCUMENTATION REQUIREMENTS

Green Star SA – Existing Building Performance
Submit all the evidence and ensure it readily confirms compliance.
1. Short report

Short report prepared by a suitably qualified individual which describes how the Credit Criteria have been met by:

- Including a detailed description of each innovation initiative;
- Articulating the nature and magnitude of the environmental benefit achieved by the initiative(s);
- Referencing evidence and calculations, wherever appropriate, that supports all claims.

- Including any evidence necessary to demonstrate that the innovation claimed is first in the world or in South Africa (must be in the form of extracts from a peer-reviewed publication, letter from independent association/organisation or other research acknowledgement).

Page limit of Short Report per innovation initiative targeted: the maximum allowed number of pages that will be permitted will be 20 pages (including all supporting documents).

ADDITIONAL GUIDANCE

Innovation points are reviewed and awarded entirely at the discretion of the GBCSA, and any decision is final.

An Innovation submission must be a concise report that clearly articulates the nature and magnitude of the environmental benefit achieved by proposed initiative(s). The report must distinctly justify and quantify the environmental or advocacy benefits of the initiative. Submissions that are purely qualitative or unsupported by documented data related to the specific initiative will not be awarded Innovation points, regardless of innovative the initiative is.

In reviewing the submission, the GBCSA will consider the environmental benefit of the innovative initiative relative to existing Green Star SA – Existing Building Performance credits where relevant.

The metric used to demonstrate environmental benefit must be the same metric as the one used in the Green Star SA – Existing Building Performance credit that is being exceeded. For example if the building significantly reduced potable water consumption the metric used must be 'in L/person/day'.

In reviewing the submission, the GBCSA will consider how many points are awarded for the credit being exceeded, the relative environmental benefits and relative score as compared to other Green Star SA – Existing Building Performance credits.

This innovation credit applies to:

- Existing Green Star SA credits with numeric benchmarks;
- Credits where the highest threshold within the credit is set below 95%; and
- Credits where exceeding the current Green Star SA benchmark would have an environmental benefit (e.g. a larger recycling waste storage area may not have additional benefit).

The Green Star SA credits where the above conditions apply are shown in the table overleaf (with their corresponding thresholds to achieve points under this innovation credit):

EB-INN-2 Exceeding Green Star SA Benchmarks

POINTS AVAILABLE 10

Credit	Threshold required to eliminate environmental impact (one point)	Threshold required to have restorative environmental impact of at least 5% (two points)
EB-Man-1 Accredited Professional	Full building management team are Accredited Professionals under the Existing Building Performance AP qualification.	Not available
EB-Man-4 Green Cleaning	100% of Cleaning Consumables comply with the credit criteria for 2 points.	Not available
EB-Man-5 Green Lease	100% of tenants have signed compliant Green Lease Clauses covering 'Fit-out' and 'Management & Operations' requirements.	Not available
EB-IEQ-2 Lighting Comfort	100% regularly occupied spaces have a maximum maintained illuminance level of no more than 80% of the levels prescribed in SANS 10114-1:2005	Not available
EB-IEQ-6 Daylight & Views	100% of regularly occupied spaces have measured daylight levels of 200 Lux or more.	Not available
	100% of regularly occupied spaces have external views in compliance with the credit criteria..	Not available
EB-Ene-1 Energy Consumption (GHGE)	The building is a net zero energy building (energy neutral) - including tenant energy demands.	The building is a net positive energy building, and produces at least more than 5% of its energy demand that is used on a neighbouring project or fed into the supply grid.

EB-INN-2 Exceeding Green Star SA Benchmarks

POINTS AVAILABLE 10

EB-Ene-2 Peak Electricity Demand Reduction	The building has a completely flat daily load profile throughout the year.	The building consumes no energy from the grid throughout the year.
EB-Tra-1 Alternative Transportation	Survey demonstrates that 100% of occupants make use of efficient alternative transport (alternative to single-occupant motor vehicle).	Not available
EB-Wat-1 Potable Water	The building is a net zero water building (water neutral).	The building is a net positive water building, and produces at least more than 5% of its water demand that is used on a neighbouring project or fed into the water supply network.
EB-Mat-2 Solid Waste Management	100% of waste generated is diverted from landfill.	100% of waste generated is diverted from landfill, and significant volumes (min 5% of building-generated volume) of waste from neighbouring sources are collected and diverted from landfill.
EB-Eco-1 Groundskeeping Practices	Not available	Where there is a formal process in place to manage and significantly improve the ecological value of a neighbouring site as part of the project, that is at least 50% the size (in m^2) of the site on which the project is located.
EB-Emi-1 Refrigerants	100% of refrigerants used are Zero GWP.	Not available
EB-Emi-3 Stormwater Management	Where no storm water leaves the site boundary of the project.	Where the site acts as a storm water retention/detention facility for neighbouring site(s) that are at least a total of 50% the size (in m^2) of the site on which the project is located.

EB-INN-2 Exceeding Green Star SA Benchmarks

POINTS AVAILABLE 10

BACKGROUND

Green Star SA consists of categories, credits and benchmarks for various green building aspects that acknowledge integrated sustainable design/construction/operation - buildings are however complex and dynamic systems, and thus it is impossible for Green Star SA to address everything possible in the rating tools that always adequately rewards projects for innovative design, construction and operation. For this reason the Innovation category exists to allow projects to be rewarded and recognised for initiatives that are either beyond current Green Star SA benchmarks or not covered within the relevant rating tool.

The GBCSA encourages projects to go beyond what Green Star SA requires, to think 'out the box' in terms of sustainable design, construction and operation in the built environment, and the GBCSA will reward and recognise projects that do so, and are able to document the initiative appropriately.

REFERENCES & FURTHER INFORMATION

The Building Research Establishment Innovation Den
http://www.bre.co.uk/innovationden

The South African Government Department of Environmental Affairs & Tourism
http://www.environment.gov.za
The South African Government Department of Science & Technology (Research & Development Tax incentives)
http://www.dst.gov.za/r-d

The Council for Scientific & Industrial Research
http://www.csir.co.za/Built_environment/

Earthlife Africa
http://www.earthlife.org.za/

The Sustainable Energy Society Southern Africa
http://www.sessa.org.za/

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.

EB-INN-3 Environmental Initiatives

POINTS AVAILABLE 10

AIM OF CREDIT

To encourage and recognise sustainable initiatives, processes or strategies that are currently outside of the scope of this Green Star SA rating tool but which have a substantial or significant environmental benefit.

CREDIT CRITERIA

One point is awarded where:

- An initiative implemented in the building viably addresses a valid environmental concern outside of the current scope of this Green Star SA tool.

Up to ten innovation initiatives can be awarded points under this credit, but no individual initiative can achieve more than one point in this credit. Qualifying initiatives may achieve additional points in other Innovation Credits, however the maximum points available for any one building assessment under Inn-1, Inn-2 and Inn-3 is ten (in total).

Refer to the list of Innovation Challenge Credits that can be targeted under this credit, found on the GBCSA website at www.gbcsa.org.za

DOCUMENTATION REQUIREMENTS

Green Star SA – Existing Building Performance
Submit all the evidence and ensure it readily confirms compliance.
1. Short report & any other relevant documentation requirements that form part of the credit-specific documentation requirements

Short report prepared by a suitably qualified individual which describes how the Credit Criteria have been met by:

- Including a detailed description of each innovation initiative and proposed credit;
- Demonstrating that the proposed credit requirements have been met by the project;
- Justifying how this credit would be different to other existing Green Star SA credits in this rating tool, and why relevant for this building type/project;
- Articulating the nature and quantifying the environmental benefit achieved by the initiative(s);

- Referencing evidence and calculations, wherever appropriate, that support all claims; and
- Following the format set out in the Green Star SA credits to:

– Identify the category that would hold this credit;
– Propose the Aim of the Credit; and
– Establish Credit Criteria and outline Documentation Requirements, based on research and comparison with other credits within that category, which would be sufficient for demonstrating compliance.

Page limit of Short Report per innovation initiative targeted: the maximum allowed number of pages that will be permitted will be 20 pages (including all supporting documents).

Additional documentation requirements: provide any other relevant documentation requirements that form part of the credit-specific documentation requirements

ADDITIONAL GUIDANCE

Innovation points are reviewed and awarded entirely at the discretion of the GBCSA, and any decision is final.

The significance of the environmental benefit of the nominated innovation must be calculated and clearly conveyed in the submission. This credit is aimed at initiatives that provide an environmental benefit and have not been addressed by existing Green Star SA – Existing Building Performance Credit Criteria.

An Innovation submission must be a concise report that clearly articulates the nature and magnitude of the environmental benefit achieved by proposed initiative(s). The reports must distinctly justify (and quantify whenever relevant) the environmental benefits of the initiative.

In essence, the report for this credit must advocate that the initiative(s) claimed for this credit be addressed by a new credit within Green Star SA.

It must be demonstrated that there is a quantified significant environmental benefit associated with the nominated innovation initiative and that it is clearly documented and integrated into the project.

Where this credit is claimed, projects must justify how this innovation initiative differs from other existing Green Star SA credits in the rating tool, and why it deserves to be included in Green Star SA for this building type. To do this, the initiative must meet the following criteria, at a minimum:

- Address a valid environmental concern;
- Be at or beyond ‘best practice’ for the current South African context;
- Be quantifiable and capable of being assessed without subjective interpretation

EB-INN-3 Environmental Initiatives

POINTS AVAILABLE 10

BACKGROUND

Green Star SA consists of categories, credits and benchmarks for various green building aspects that acknowledge integrated sustainable design/construction/operation - buildings are however complex and dynamic systems, and thus it is impossible for Green Star SA to address everything possible in the rating tools that always adequately rewards projects for innovative design, construction and operation. For this reason the Innovation category exists to allow projects to be rewarded and recognised for initiatives that are either beyond current Green Star SA benchmarks or not covered within the relevant rating tool.

The GBCSA encourages projects to go beyond what Green Star SA requires, to think 'out the box' in terms of sustainable design, construction and operation in the built environment, and the GBCSA will reward and recognise projects that do so, and are able to document the initiative appropriately.

REFERENCES & FURTHER INFORMATION

The Building Research Establishment Innovation Den
http://www.bre.co.uk/innovationden

The South African Government Department of Environmental Affairs & Tourism
http://www.environment.gov.za

The South African Government Department of Science & Technology (Research & Development Tax incentives)
http://www.dst.gov.za/r-d

The Council for Scientific & Industrial Research
http://www.csir.co.za/Built_environment/

Earthlife Africa
http://www.earthlife.org.za/

The Sustainable Energy Society Southern Africa
http://www.sessa.org.za/

TECHNICAL CLARIFICATIONS AND ERRATUM

There are currently no Technical Clarifications or Errata issued for this credit.